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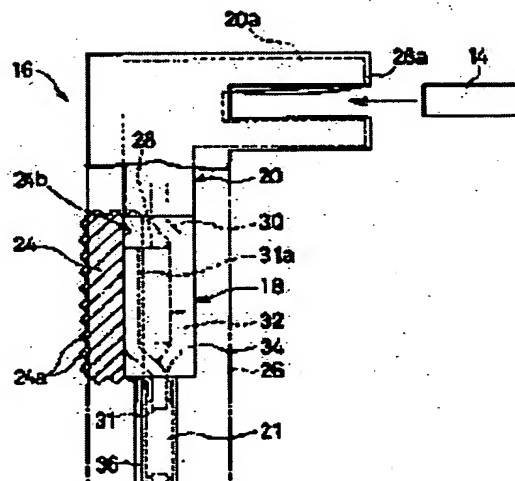
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(54) CONNECTOR AND ELECTRICAL CONNECTION BOX

(57)Abstract:

PROBLEM TO BE SOLVED: To efficiently protect another electronic device from heat radiation of a control device by connecting the control device to an electric current circuit through a first connecting member and connecting the control device to a control circuit through a second connecting member.

SOLUTION: An electric field effect transistor(FET) 18 and a heat radiating plate 24 are integrally connected to each other in a state where a heat radiating part 31a of the FET 18 and the heat radiating plate 24 make contact



with each other. As an electric current which is the same as an electric current flowing in a bus bar circuit flows in the FET 18, heat radiation takes place in the FET 18. As the FET 18 is arranged at a position between a bus bar substrate 13 and an electronic circuit substrate 14 in a state of being separated from both of the substrates 13, 14 in an electrical connection box and the heat radiating plate 24 making contact with a heat radiating part 31a of the FET 18 is in a state of being exposed outside of a connector housing 26, heat radiating work of this FET 18 is high, and it is possible to prevent its radiated heat from badly influencing upon each of electronic devices on the electronic circuit substrate 14.

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CLAIMS

[Claim(s)]

[Claim 1] A connector characterized by incorporating at one the 1st connection material for connecting a control device and this control device for controlling current which flows a current circuit in the above-mentioned current circuit, and the 2nd connection material for connecting the above-mentioned control device to a control circuit which controls actuation of this device in connector housing.

[Claim 2] A connector characterized by having formed a radiator in the above-mentioned control device, and exposing this radiator to the exterior of the above-mentioned connector housing in a connector according to claim 1.

[Claim 3] A connector characterized by having formed a radiator in the above-mentioned control device, and having connected with the radiator concerned radiator material which has bigger surface area than this radiator in a connector according to claim 1, and exposing this radiator material to the exterior of the above-mentioned connector housing.

[Claim 4] A connector characterized by making a cooling element which cools the above-mentioned radiator in a connector according to claim 3 by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between a radiator of the above-mentioned control device, and the above-mentioned radiator material intervene.

[Claim 5] A connector characterized by including in one connection material for cooling which connects the above-mentioned cooling element to the above-mentioned connector housing in a control circuit of the 2nd circuit board of the above in a connector according to claim 4.

[Claim 6] A connector characterized by connection material of the above 1st and the 2nd connection material having turned to an opposite direction mutually in a connector according to claim 1 to 5.

[Claim 7] A connector characterized by making a separator which consists of an insulating material among two or more 1st connection material intervene in a connector according to claim 6.

[Claim 8] An electric junction box characterized by arranging the above-mentioned control device in a location between the 1st circuit board of the above, and the 2nd circuit board while having the 1st circuit board in which a current circuit was included, a control device for controlling current which flows the above-mentioned current circuit, and the 2nd circuit board in which a control circuit which controls actuation of this control device was included.

[Claim 9] an electric junction box according to claim 8 -- setting -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation, while making it estrange mutually and arranging in the parallel condition A control device with which a control terminal connected with two or more energization terminals connected to a current circuit of the 1st circuit board of the above in a control circuit of the 2nd circuit board of the above projects in the opposite direction mutually An electric junction box characterized by arranging among both substrates in the condition that the above-mentioned energization terminal turns to a circuit board side of the above 1st, and sense and the above-mentioned control terminal turn to a circuit board side of the above 2nd.

[Claim 10] An electric junction box characterized by connecting radiator material with larger surface area than this radiator with a radiator of the above-mentioned control device in an electric junction box

according to claim 8 or 9.

[Claim 11] An electric junction box characterized by connecting common radiator material prolonged in a radiator of these control devices at the 2nd circuit board of the above, and abbreviation parallel in an electric junction box according to claim 10 while installing two or more control devices between the 1st circuit board of the above, and the 2nd circuit board.

[Claim 12] An electric junction box characterized by making a cooling element which cools a radiator in an electric junction box according to claim 10 or 11 by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between a radiator of the above-mentioned control device, and the above-mentioned radiator material intervene.

[Claim 13] An electric junction box characterized by including a cooling control section which controls actuation of the above-mentioned cooling element based on temperature detected by this temperature detection means in the 2nd circuit board of the above while having a temperature detection means to detect temperature of the above-mentioned control device, or temperature corresponding to this, in an electric junction box according to claim 12.

[Claim 14] An electric junction box characterized by having had the following, having connected the above-mentioned current circuit to the 1st connection material of the above-mentioned connector, and connecting the above-mentioned control circuit to the 2nd connection material of the above-mentioned connector. The 1st circuit board in which a current circuit was included A connector according to claim 1 to 7 into which a control device for controlling current which flows the above-mentioned current circuit was built The 2nd circuit board in which a control circuit which controls actuation of the above-mentioned control device was included

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the connector and electric junction box which are used for the wire harness for automobiles etc.

[0002]

[Description of the Prior Art] An example of the circuitry in the conventional electric junction box is shown in drawing 17. In drawing, the bus bar substrate (the 1st circuit board) 90 and the electronic-circuitry substrate (the 2nd circuit board) 92 are arranged on abbreviation parallel, and the connector 94 is interposed between both the substrates 90 and 92 comrades.

[0003] A power circuit etc. is connected to the bus bar circuit (current circuit) included in the bus bar substrate 90 through the electric wire of **** etc., and comparatively big current is passed by this bus bar circuit in it. On the electronic-circuitry substrate 92, FET (field-effect transistor) 96, the gate signal input circuit which inputs a gate signal (control signal) into the gate terminal of this FET 96 are carried. And the energization terminal (a source terminal and drain terminal) of the above FET 96 is connected to the above-mentioned bus bar circuit through the flow section in the above-mentioned connector 94, and the current which flows the above-mentioned bus bar circuit is controlled by the gate signal inputted into this FET 96.

[0004] Thus, although current equivalent to the current which flows a bus bar circuit is passed between the source drains of the above FET 96, this current is remarkably large compared with the current which flows the control circuit of the electronic-circuitry substrate 92, and, therefore, the calorific value of FET 96 becomes very large compared with the electron device mounted on the same electronic-circuitry substrate 92. Then, while carrying out exposing some energization terminals on the surface of FET 96 etc. that this FET 96 should be cooled effectively and forming a radiator conventionally, means like the illustration to this radiator to connect the heat sink 98 of a large area comparatively are taken.

[0005]

[Problem(s) to be Solved by the Invention] With the above-mentioned configuration, since FET 96 is directly mounted on the circuit board 92, propagation and a possibility of doing a bad influence at actuation of these devices are in other electron devices with which the heat released out of FET 96 was mounted on the same electronic-circuitry substrate 92.

[0006] This invention aims at offering the connector and electric junction box which can protect other electron devices from thermolysis of control devices including FET effectively in view of such a situation.

[0007]

[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, this invention incorporates at one the 1st connection material for connecting a control device and this control device for controlling current which flows a current circuit in the above-mentioned current circuit, and the 2nd connection material for connecting the above-mentioned control device to a control circuit which controls actuation of this device in connector housing.

[0008] According to this connector, while connecting that control device to a current circuit through the 1st connection material, current of a current circuit is controllable by this control device, controlling actuation of a control device by this control circuit by connecting the above-mentioned control device to a control circuit through the 2nd connection material. In this condition, since it is in a location where the above-mentioned control device separated from the above-mentioned control circuit, it prevents telling heat released out of a control device directly to other electron devices on the above-mentioned control board etc. unlike structure of mounting the above-mentioned control device on a control board like before.

[0009] In this connector, if a radiator is formed in the above-mentioned control device and this radiator is exposed to the exterior of the above-mentioned connector housing, heat can be more efficiently radiated in heat with which a control device emits a control device compared with structure conventionally which is mounted on a control board, and that fault temperature up can be prevented.

[0010] Moreover, if radiator material which has bigger surface area than a radiator of the above-mentioned control device is connected with the radiator concerned and this radiator material is exposed to the exterior of the above-mentioned connector housing, a thermolysis operation from this control device will be raised further.

[0011] Although the above-mentioned radiator material may be directly contacted to a radiator of the above-mentioned control device, if a cooling element which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator among these is made to intervene, thermolysis from a radiator can be promoted further.

[0012] Furthermore, when connection material for cooling which connects the above-mentioned cooling element to a control circuit of the 2nd circuit board of the above is included in one and a cooling element and a control circuit were connected to the above-mentioned connector housing through this connection material for cooling, it was also able to be said that actuation of a cooling element was controlled using this control circuit.

[0013] As for connection material of the above 1st, and the 2nd connection material, it is desirable that these have turned to an opposite direction mutually. Thereby, an activity which connects a control device to both sides of a current circuit and a control circuit becomes easy, and wiring structure also becomes easy.

[0014] It can avoid more certainly that energization terminals short-circuit by making a separator which consists of an insulating material intervene among the above-mentioned energization terminals in that case.

[0015] Moreover, this invention is the electric junction box which arranged the above-mentioned control device in a location between the 1st circuit board of the above, and the 2nd circuit board while being equipped with the 1st circuit board in which a current circuit was included, a control device for controlling current which flows the above-mentioned current circuit, and the 2nd circuit board in which a control circuit which controls actuation of this control device was included.

[0016] In this configuration, since a semiconductor device is arranged among both substrates, compared with structure, it is easy to radiate heat from a semiconductor device conventionally by which this semiconductor device is mounted on the 2nd circuit board, and that fault temperature up is avoided. Moreover, telling heat released out of this semiconductor device directly to an electron device of the 2nd circuit board etc. can also be prevented. And since a semiconductor device is originally arranged among both substrates that are carrying out mutual alienation, it does not need to enlarge the whole electric junction box, and connection between a semiconductor device and both substrates is also easy for it.

[0017] especially -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation -- as the above-mentioned semiconductor device, when making it estrange mutually and arranging in the parallel condition If that to which a control terminal connected with two or more energization terminals connected to a current circuit of the 1st circuit board of the above in a control circuit of the 2nd circuit board of the above projects in the opposite direction mutually is used Connection with a circuit included in each terminal and each substrate of this semiconductor device can be simply performed by arranging a semiconductor device among both substrates, where it turned that energization terminal to a circuit

board side of the above 1st and the above-mentioned control terminal is turned to a circuit board side of the above 2nd.

[0018] Moreover, if radiator material with larger surface area than this radiator is connected with a radiator of the above-mentioned semiconductor device, a thermolysis operation from this semiconductor device will be raised further.

[0019] Although neither a configuration of this radiator material nor especially arrangement is asked, while installing two or more semiconductor devices between the 1st circuit board of the above, and the 2nd circuit board If common radiator material prolonged in the 2nd circuit board of the above and abbreviation parallel is connected with a radiator of these semiconductor devices, using effectively space inserted into both substrates, radiator material of a large area can be introduced without making the whole electric junction box enlarge, and the part thermolysis operation can be promoted further.

Moreover, since thermolysis of two or more semiconductor devices by common radiator material can be promoted, components mark are also reduced compared with a case where radiator material is allotted for every semiconductor device. Furthermore, since the above-mentioned radiator material will be in a wrap condition from one side about the 2nd circuit board of the above, it also becomes possible to make this radiator material serve a double purpose as shield material of the 2nd circuit board.

[0020] Although the above-mentioned radiator material may be directly contacted to a radiator of the above-mentioned semiconductor device, if a cooling element which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator among these is made to intervene, thermolysis from a radiator can be promoted further.

[0021] Although un-arranging [that dew condensation occurs on the surface of this semiconductor device] may arise here when cooling of a semiconductor device is unnecessary (at for example, the time of un-operating), it carries out that a cooling element operates etc. and a semiconductor device is supercooled Like a Peltier device, by supply current from the outside etc., when the above-mentioned cooling element is an element in which actuation control is possible, while it is equipped with a temperature detection means to detect temperature of the above-mentioned semiconductor device, or temperature corresponding to this By including a cooling control section which controls actuation of the above-mentioned cooling element based on temperature detected by this temperature detection means in the 2nd circuit board of the above, proper temperature control corresponding to the actual condition can be performed.

[0022] Although you may make it arrange the above-mentioned semiconductor device among both substrates independently, said each connector is used, i.e., assembly operation of the whole electric junction box becomes easy by connecting the above-mentioned current circuit to the 1st connection material of this connector, and connecting the above-mentioned control circuit to the 2nd connection material of the above-mentioned connector.

[0023]

[Embodiment of the Invention] The gestalt of operation of the 1st of this invention is explained based on drawing 1 - drawing 7.

[0024] The electric junction box 10 shown in drawing 1 is equipped with the lower case 11 and the upper case 12. Engagement section 11b is formed in side wall 11a of a lower case 11, engagement section 12b is formed in side wall 12a of an upper case 12, and both the cases 11 and the connection condition of 12 comrades are held by engagement of both engagement section 11b and 12b.

[0025] The bus bar substrate 13 is arranged on the above-mentioned lower case 11. Much tab 13a has started from this bus bar substrate 13 to the upper part. A power circuit etc. is connected to the bus bar circuit (current circuit) included in this bus bar substrate 13 through the electric wire of **** etc., and comparatively big current is passed by this bus bar circuit in it.

[0026] Rather than the above-mentioned bus bar substrate 13, two or more stanchion 11c which projects up further is set up by the periphery section of a lower case 11, and the electronic-circuitry substrate 14 is supported by such stanchion 11c. namely, this electronic-circuitry substrate 14 -- the above-mentioned bus bar substrate 13 and abbreviation -- it is in an parallel condition and is supported by the location estranged from this bus bar substrate to the upper part. Many electron devices 15 are mounted in this

electronic-circuitry substrate 14, and the control circuit which inputs a gate signal into below-mentioned FET18 with these electron devices 15 is constituted.

[0027] And the connector 16 as shown in drawing 2 - drawing 6 is interposed between this electronic-circuitry substrate 14 and the above-mentioned bus bar substrate 13. This connector 16 is equipped with the above FET 18 and the gate splicing fitting (2nd connection material) 20 which are a control device, the drain splicing fitting (1st connection material) 21, the source splicing fitting (2nd connection material) 22, and a heat sink 24, and these whole is included in the connector housing 26 made of resin by one with mold shaping.

[0028] The connector housing 26 is prolonged in the periphery section of the electronic-circuitry substrate 14, and parallel, and the upper limit section is crooked in the electronic-circuitry substrate 14 side. a part for and this flection -- the two forks in which the side to the plug of the periphery section of the above-mentioned electronic-circuitry substrate 14 is possible -- clip section 26a of a ** is formed.

[0029] The semiconductor chip 28 which is an FET main part, a gate terminal (control terminal) 30, the drain terminal (energization terminal) 31, and the source terminal (energization terminal) 32 are covered with the housing 34 made of resin, and FET18 can be manufactured with mold shaping etc., as shown in drawing 7 (a) - (c).

[0030] The above-mentioned gate terminal 30 and the source terminal 32 are joined by the side (drawing 7 (b) right lateral) of the same side in the above-mentioned semiconductor chip 28, and the above-mentioned drain terminal 31 is connected to the side of this and the opposite side. The portion joined by the above-mentioned side in this drain terminal 31 is set to radiator 31a which has an area equivalent to the side concerned, and this radiator 31a has exposed it to the side of the above-mentioned housing 34.

[0031] Furthermore, as a feature of this FET18, among the three above-mentioned terminals 30-32, only the gate terminal 30 was prolonged in the upper part from the above-mentioned semiconductor chip 28, and it has projected from the upper surface of housing 34 to the upper part, and remaining drain terminals 31 and source terminals 32 were caudad prolonged in abbreviation parallel in the condition of having ranked with right and left mutually, and are caudad projected from the inferior surface of tongue of housing 34 in it, respectively.

[0032] The gate splicing fitting 20 is arranged on the upper part of a connector 16, and the lower limit of this gate splicing fitting 20 is connected with the gate terminal of the above FET 18. the upper part of this gate splicing fitting 22 -- the side -- being crooked -- a part for that point -- clip section 26a of the above-mentioned connector housing 26 -- the same -- the two forks (namely, the side to a plug is possible for the electronic-circuitry substrate 14) which can pinch the periphery section of the above-mentioned electronic-circuitry substrate 14 from the upper and lower sides -- clip section 20a of a ** is formed. and the conductor which constitutes the control circuit of this electronic-circuitry substrate 14 after this clip 20a has pinched the periphery section of the electronic-circuitry substrate 14 -- partial 14a contacts the above-mentioned clip section 20a, and the above-mentioned control circuit is electrically connected to the gate terminal 30 of FET18 through the gate splicing fitting 20.

[0033] The drain splicing fitting 21 and the source splicing fitting 22 are making mutually the same configuration and the configuration which is specifically prolonged up and down and has the engagement section of a female mold to the vertical both ends, the lower limit section of the drain terminal 31 of the above FET 18 is inserted in the upper limit section of the drain splicing fitting 21, and the lower limit section of the source terminal 32 is inserted in the upper limit section of the source terminal 22.

[0034] Between both the splicing fitting 21 and 22 comrades, the separator 36 which consists of an insulating material intervenes. The whole is unified by mold shaping and, as for these splicing fitting 21 and 22 and a separator 36, the insulation of both the splicing fitting 21 and 22 comrades is secured by mediation of this separator 36. And these tab 13a is connected to the above-mentioned drain terminal 31 and the source terminal 32 according to an individual through each splicing fitting 21 and 22 by inserting suitable tab 13a in the above-mentioned bus bar substrate 13 in the lower limit section of both the splicing fitting 21 and 22 from a lower part. That is, FET18 is incorporated all over a bus bar circuit.

[0035] A heat sink 24 is fabricated with the material excellent in conductivity, such as aluminum, and has the configuration prolonged at a horizontal to the size of the connector housing 26 and an abbreviation EQC. And after the surface of this heat sink 24 has been exposed to the lateral surface (the side of the electronic-circuitry substrate 14 and the opposite side; drawing 2 right lateral) of the connector housing 26, this heat sink 24 is also included in the connector housing 26. Protruding line 24a of a large number prolonged horizontally is formed in the surface of this heat sink 24, and, thereby, the heat sinking plane product of a heat sink 24 is increased.

[0036] Crevice 24b is formed in the medial surface of this heat sink 24, and by inserting in this crevice 24b one flank (flank of the side which radiator 31 of drain terminal 31a has specifically exposed) of the housing 34 of FET18, after radiator 31a of FET18 and a heat sink 24 have contacted, these FET18 and a heat sink 24 are combined with one.

[0037] Next, an operation of this electric junction box 10 is explained.

[0038] There are some bus bar circuits which were included in the bus bar substrate 13 and into which comparatively big current is inputted through the electric wire of **** etc. The middle, the comparatively big current passed in this circuit flows in order of source terminal 32 -> semiconductor chip 28 -> drain terminal 31 -> drain splicing fitting 21 -> tab 13a of tab 13a -> source splicing fitting 22 -> FET18 shown in drawing 2 - drawing 6, and is outputted from a bus bar circuit. On the other hand, a gate signal is inputted into the gate terminal 30 of the above FET 18 through the gate splicing fitting 20 from the control circuit included in the electronic-circuitry substrate 14, and the amount of energization between the source-drains in the above FET 18 is controlled by this gate signal.

[0039] Thus, since current equivalent to the current which flows a bus bar circuit flows to FET18, pyrexia takes place to FET18. Since FET18 was conventionally mounted on the electronic-circuitry substrate 14 with other electron devices here, Although sufficient thermolysis operation had a possibility that the heat which is hard to be obtained and this FET18 emits might get across to other electron devices, and might have a bad influence also on the engine performance of these electron devices even if it connected the heat sink etc. with this FET18 With the electric junction box 10 shown in drawing 1 - drawing 7, after FET18 has separated from the both sides of the bus bar substrate 13 and the electronic-circuitry substrate 14, it is allotted to the location between both the substrates 13 and 14 comrades. Since the heat sink 24 in contact with radiator 31a of FET18 is in the condition of having exposed to the way outside the connector housing 26, a thermolysis operation of this FET18 is high, and it can prevent that released heat having a bad influence on each electron device on the electronic-circuitry substrate 14. And since both the substrates 13 and 14 are arranged in the condition of having estranged mutually from the first, although FET18 is arranged among these, it is not necessary to enlarge especially the electric junction box 10.

[0040] The gestalt of the 2nd operation is shown in drawing 8. Although the heat sink 24 which turned radiator 31a of FET18 to the lateral surface of a connector 16, and was connected with this radiator 31a is exposed to the above-mentioned lateral surface with the gestalt of said 1st operation, with the gestalt of this 2nd operation, the above-mentioned radiator 31a was turned to the medial surface of a connector 16, and the heat sink 24 connected with this heat sink 31a is turned to the above-mentioned medial surface.

[0041] Thus, what is necessary is to have not asked concrete arrangement of the radiator material of heat sink 24 grade, but just to fully have exposed it from the connector housing 26 in this invention.

[0042] The gestalt of the 3rd operation is shown in drawing 9. Here, the both ends of the electronic-circuitry substrate 14 are connected with the bus bar substrate 13 through the connector 16. That is, two connectors 16 are arranged in the condition of carrying out phase opposite, between the electronic-circuitry substrate 14 and the bus bar substrate 13. And radiator 31a of FET18 included in each connector 16 is directly exposed to the field (medial surface) which counters mutually in each connector 16, and the single heat sink 38 is connected with it at these radiator 31a. namely, this heat sink 38 -- between the bus bar substrate 13 and the electronic-circuitry substrates 14 -- these and abbreviation -- it is allotted in the parallel condition and intervenes among radiator 31a of both the connectors 16. moreover -- the inferior surface of tongue of this heat sink 38 -- many -- fin of several sheets 38a is

formed and, thereby, the increment in a heat sinking plane product is achieved.

[0043] According to such a configuration, in addition to the effect acquired with the gestalt of said the 1st and 2nd operation, the following effects can be acquired.

[0044] ** The heat sink 38 of a large area can be arranged by using effectively the space inserted into the bus bar substrate 13 and the electronic-circuitry substrate 14, without enlarging the electric junction box 10 whole. Therefore, though it is compact structure, the outstanding thermolysis operation can be acquired.

[0045] ** By the common heat sink 38, the thermolysis from FET18 in two or more connectors 16 can be promoted, and components mark can be reduced.

[0046] ** By the metal heat sink 38, since the inferior surface of tongue of the electronic-circuitry substrate 14 can be mostly covered over the whole region, this heat sink 38 can be made to serve a double purpose as shield material, and, thereby, can protect the electronic-circuitry substrate 14 from an electromagnetic wave effectively. Furthermore, a shielding effect will become thoroughgoing, if a metal plate is arranged also on said upper case 12 and the electronic-circuitry substrate 14 is covered with a metal plate also from the upper part.

[0047] Next, the gestalt of the 4th operation is explained based on drawing 10 - drawing 12.

[0048] With the gestalt of this operation, Peltier device (cooling element) 40 is interposed between radiator 31a of FET18, and a heat sink 24 in the connector 16 shown with the gestalt of said 1st operation. This Peltier device 40 is equipped with the terminal of a pair, and in connection with current being passed among these terminals, it is a degree corresponding to the magnitude of this current, and it is constituted so that heat transfer may be made to start in the direction which goes to a heat sink 24 from above-mentioned radiator 31a compulsorily.

[0049] On the other hand, the temperature sensor (temperature detection means) 42 as shown in drawing 12 is built into said FET18. This temperature sensor 42 consists of a thermocouple etc., and it is constituted so that the electrical signal equivalent to the exoergic temperature of FET18 may be outputted.

[0050] As shown in drawing 11, the splicing fitting 50A and 50B for cooling (connection material for cooling) and the splicing fitting 52 for detection (connection material for detection) of a pair of a configuration (namely, configuration which has the clip section whose electronic-circuitry substrate 14 is pinched) equivalent to this gate splicing fitting 20 are built into the upper part of a connector 16 in the condition of standing in a line at a level with said gate splicing fitting 20. Each terminal of said Peltier device 40 is connected to each splicing fitting 50A and 50B for cooling through the wiring in a connector of ****, and the output terminal of the above-mentioned temperature sensor 42 is connected to the splicing fitting 52 for detection. And the above-mentioned gate terminal 30, the both-ends child of Peltier device 40, and the output terminal of a temperature sensor 42 are connected concurrently to the control circuit included in this electronic-circuitry substrate 14 by inserting the periphery section proper place of the electronic-circuitry substrate 14 in the clip section of each above-mentioned splicing fitting 20, 50A, 50B, and 52 at coincidence.

[0051] The control circuit included in the above-mentioned electronic-circuitry substrate 14 is equipped with the temperature data analysis section 44 and the current controller 46 as shown in drawing 12 besides the above-mentioned gate signal generating section, and the warning command section 48.

[0052] The temperature data analysis section 44 is constituted so that the temperature data inputted from a temperature sensor 42 is analyzed, the control signal corresponding to the temperature may be outputted to the current controller 46 when detection temperature is beyond the 1st decision value, and a warning control signal may be outputted at the warning command section 48 in beyond the 2nd decision value with a detection temperature higher than the 1st decision value of the above.

[0053] The current controller 46 passes the current corresponding to this control signal among the both-ends children of Peltier device 40, when a control signal is inputted from the above-mentioned temperature data analysis section 44. That is, this current controller 46 is constituted so that such big current that that temperature is high when the above-mentioned detection temperature is more than fixed may be passed among the both-ends children of Peltier device 40. Moreover, when a control signal is

inputted from the above-mentioned temperature data analysis section 44, the warning command section 48 outputs a command signal to the warning means of **** formed in the electric junction box exterior, and it is constituted so that it may be made to warn.

[0054] If pyrexia of FET18 becomes remarkable, since according to such a configuration between the both-ends children of Peltier device 40 will energize, Peltier device 40 will operate and the compulsory heat transfer from FET18 to a heat sink 40 will be caused, the thermolysis to the open air which leads a heat sink 24 from FET18 by this is promoted, and the extremes-of-temperature rise of FET18 is avoided. moreover, since actuation of Peltier device 40 is suspended when the temperature of FET18 is comparatively low, it is based on the supercooling of FET18 -- being also inconvenient (for example, generating of dew condensation) -- it can protect.

[0055] In addition, you may make it the temperature set as the object of detection detect not only exoergic temperature of the above own [FET18] but its ambient temperature, and the temperature of the gate splicing fitting 20 in the gestalt of this operation. Moreover, the temperature of the elevated-temperature side (drawing 11 drawing 10 and left lateral) of Peltier device 40 is detected, and if energization of Peltier device 40 is stopped when this temperature rises too much, failure of Peltier device 40 self can also be prevented.

[0056] Moreover, you may make it make Peltier device 40 intervene, respectively between both the connectors 16 shown with the gestalt of said 3rd operation, and the both ends of a heat sink 38, as the connector 16 which can introduce this Peltier device 40 is not restricted to what was shown in the gestalt of said 1st operation, for example, is shown in drawing 13 as a gestalt of the 5th operation.

[0057] The gestalt of the 6th operation is shown in drawing 14 (a) and (b). although said each operation gestalt showed what used the connector 16 incorporating this for connection within an electric junction box, using FET as a control device, while using the connector 16 which incorporated IPS (Intelligent Power Switch) as a control device with the gestalt of this operation -- this connector 16 -- the inside of an electric junction box -- setting -- coming out -- there is nothing, direct continuation is carried out to a power supply and a load, and it is made to perform that flow control.

[0058] Above IPS has the power section 60 and the intelligent section 62. In the power section 60, the switching element which consists of FET etc., an internal electrical power source, a thermo-sensitive device, etc. are incorporated. The intelligent section 62 consisted of logical circuits etc., and is equipped with the function to judge the existence of abnormalities based on detecting signals, such as the above-mentioned thermo-sensitive device, the function to perform on-off control of the above-mentioned switching element based on the command inputted from an external control circuit, etc.

[0059] A grounding terminal 63, the input terminal 64 into which the above-mentioned command is inputted, and the diagnostic-output terminal 65 for outputting an abnormality diagnostic signal to the above-mentioned control circuit are formed in the intelligent section 62, and these terminals are equipped with splicing fitting 68. On the other hand, a power supply terminal 67 and an output terminal 66 are formed in the above-mentioned power section 60, a power supply terminal 67 is equipped with splicing fitting 77, and the output terminal 66 is equipped with splicing fitting 76. And mold shaping of the connector housing 70 is carried out on the outside that these whole should be unified, and the connector 16 is constituted. While the above-mentioned input terminal 64 and the diagnostic-output terminal 65 are connected to the above-mentioned control circuit through splicing fitting (2nd connection material) 68, respectively A power supply terminal 67 is connected to a power supply through splicing fitting (1st connection material) 77, and the output terminal 66 is connected to the load through splicing fitting (1st connection material) 76.

[0060] Even if it uses such a connector 16, energization between power supply-loads can be turned on and off by actuation of IPS which is a control device, and actuation of this IPS can be controlled by the control circuit. And efficient thermolysis can be performed by making IPS estrange from this control circuit by being able to protect the circuit element of a control circuit and exposing the power supply terminal 67 of Above IPS on the external surface of the connector housing 70. Furthermore, the thermolysis effect can be heightened by introducing a heat sink and a suitable cooling element like the above.

[0061] Moreover, when Above IPS builds in two or more switching elements (i.e., as shown in drawing 15 (a) and (b) as a gestalt of the 7th operation, also when it has two or more input terminals 64 and output terminals 66), the connector 16 with which the whole was united like the gestalt of implementation of said 6th operation can be constituted.

[0062] In addition, you may make it the connector of this invention connect the 1st [as shown in said drawing 2 , not only when carrying out direct continuation to the bus bar substrate 13 and the electronic-circuitry substrate 14, but] connection material to a current circuit through an electric wire, and may make it connect the 2nd connection material to a control circuit through an electric wire. For example, you may make it connect to splicing fitting 68 and splicing fitting 76 and 77 the cable terminal and connector which were prepared in the terminal of the above-mentioned electric wire in the case of the connector 16 shown in drawing 14 (a) and (b).

[0063] Thus, since the arrangement location of a connector can be freely set to the structure which connected the connector of this invention to the current circuit and the control circuit through the electric wire, respectively, when thermolysis of the electron device inserted especially in the interior of a connector is remarkable, the advantage which can prevent the thermal run away of the above-mentioned electron device is acquired by installing only a part for a connector area in the location where environmental temperature is low.

[0064] On the other hand, if the wiring gestalt which carries out direct continuation of the 1st connection material of the connector of this invention to the load or power supply terminal, and connects the 2nd connection material of the connector of this invention to a current circuit side through an electric wire at a control circuit side is taken It is possible to be able to carry out [shortest]-izing of the path for which it flows, the path, i.e., the high current, between a current circuit and the connector of this invention, to abolish the necessity of arranging the large diameter electric wire for high currents on this path; and to reduce cost remarkably, making a current circuit estrange greatly from the above-mentioned control circuit comparatively weak with heat. Moreover, the noise which comes out of the above-mentioned high current path can be prevented using the minimum cutoff material.

[0065] Moreover, to a current circuit, the 1st connection material of the connector of this invention is connected to reverse through an electric wire, and when it can be made to carry out to the connector for substrates of the circuit board in which the control circuit was included etc. direct continuation of the 2nd connection material, the advantage which can combine the connector of this invention with the above-mentioned connector for substrates etc. easily is acquired, making a control circuit and a current circuit estrange greatly. Moreover, since a high current does not flow the above-mentioned circuit board top, the temperature rise of the substrate concerned and generating of a radiation noise can be prevented, and the advantage which can prevent malfunction of the control circuit included in this substrate is acquired.

[0066] Although various methods of manufacturing a connector 16 in this invention are considered, the example is shown in drawing 16 (a) - (c).

[0067] First, as shown in drawing 16 (a), while manufacturing what equipped the power section 60 of IPS with the power supply terminal 67 and the output terminal 66, as shown in this drawing (b), mold shaping of the connector housing 72 with which the splicing fitting 73 for grounding terminals, the splicing fitting 74 for diagnostic-output terminals, and the splicing fitting 75 for input terminals were fixed is carried out, and what was shown by said drawing 16 (a) is fixed to crevice 72a formed in this connector housing 72. next, it is shown in this drawing (c) -- as -- each terminal of the power section 60 -- each above-mentioned splicing fitting 73, 74, and 75 -- a wire 78 -- minding -- connecting (that is, it connecting by wirebonding etc.) -- a power supply terminal 67 and an output terminal 66 are equipped with splicing fitting 77 and 76, respectively. And a connector can be completed by putting a lid for a part for a connection with the above-mentioned wire 78 on the connector housing 72 from a top a cover and if needed by resin mold etc. at least.

[0068] This invention can also take the following gestalten as an example besides the gestalt of the above-mentioned operation.

[0069] (1) In the gestalt of said 1st operation etc., it is also possible to interpose between both the

substrates 13 and 14 comrades in the condition of having omitted the connector housing 26 and having made the full exposure of FET18 carrying out outside. The thermolysis effect can be promoted by connecting the radiator material of heat sink 24 grade with the radiator of FET18 also in this case, or making Peltier device 40 intervene between this radiator material and FET18. However, like said each operation gestalt, if the above FET 18 is unified as a single connector 16 with each splicing fitting 20-22, the advantage which can carry out [easy]-izing of the assembly operation of the electric junction box 10 whole will be acquired.

[0070] (2) In addition to this, the control device in this invention can apply IGBT (Insulated Gate Bipolar Transistor), BPT (Bipolar Transistor), various regulators, a power module, etc. not only in the above [FET or IPS] 18. However, if the control device with which a control terminal (the example of drawing gate terminal 30) and an energization terminal (the example of drawing the drain terminal 31 and the source terminal 32) project in an opposite side mutually is used as shown in said each operation gestalt The advantage which can simplify connection structure is acquired by interposing this control device between both the substrates 13 and 14 in the condition that the above-mentioned energization terminal turns to the above-mentioned bus bar substrate 13 side (the example of drawing under), and the sense and a control terminal turn to the electronic-circuitry substrate 14 side (above).

[0071] (3) The 1st circuit board in this invention can apply the various circuit boards by which the conductor was built into the substrate which consists not only of the above bus bar substrates 13 but of an insulating material.

[0072]

[Effect of the Invention] A control device for this invention to control the current which flows a current circuit as mentioned above, The 1st connection material for connecting this control device to the above-mentioned current circuit, Since it is the connector which incorporated at one the 2nd connection material for connecting the above-mentioned control device to the control circuit which controls actuation of this device in connector housing It is effective in the ability to protect other electron devices which constitute the above-mentioned control circuit from thermolysis of a control device, controlling the current in a current circuit by connecting this connector to the above-mentioned current circuit and a control circuit.

[0073] And by forming a radiator in the control device of this connector, and exposing this radiator to the exterior of the above-mentioned connector housing, the heat which a control device emits can be radiated efficiently and the effect that that fault temperature up can be prevented is acquired.

[0074] Moreover, the thermolysis effect can be made still more remarkable by connecting with the radiator concerned the radiator material which has bigger surface area than the radiator of the above-mentioned control device, and exposing this radiator material to the exterior of the above-mentioned connector housing.

[0075] Furthermore, according to the thing between which the cooling element which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between the above-mentioned radiator material and a radiator was made to be placed, the effect that the thermolysis from a radiator can be promoted positively is acquired.

[0076] Furthermore, the effect which can control actuation of a cooling element using this control circuit is acquired by connecting a cooling element and a control circuit to the above-mentioned connector housing through this connection material for cooling according to what included in one the connection material for cooling which connects the above-mentioned cooling element to the control circuit of the 2nd circuit board of the above.

[0077] Moreover, according to that the connection material of the above 1st and the 2nd connection material have turned [that] to the opposite direction mutually, the activity which connects a control device to the both sides of a current circuit and a control circuit is done easy, and the effect which can also simplify wiring structure is acquired.

[0078] Furthermore, the effect which can be avoided more certainly is acquired [that energization terminals short-circuit and] by making the separator which consists of an insulating material intervene among the above-mentioned energization terminals.

[0079] Moreover, while this invention is equipped with the 1st circuit board in which the current circuit was included, the control device for controlling the current which flows the above-mentioned current circuit, and the 2nd circuit board in which the control circuit which controls actuation of this control device was included. Since it is the electric junction box which arranged the above-mentioned control device in the location between the 1st circuit board of the above, and the 2nd circuit board. While promoting thermolysis of a control device and being able to secure that good actuation compared with structure conventionally by which this control device is mounted on the 2nd circuit board, it is effective in the ability to prevent that the heat released out of this control device has a bad influence on the electron device of the 2nd circuit board etc. Moreover, although a control device is arranged on the location between both substrates, it is not necessary to enlarge the whole electric junction box specially, and the above-mentioned effect is acquired with compact structure, and-izing also of the connection between a control device and both substrates can be carried out [easy].

[0080] especially -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation -- as the above-mentioned control device, when making it estrange mutually and arranging in the parallel condition. If that to which the control terminal connected with two or more energization terminals connected to the current circuit of the 1st circuit board of the above in the control circuit of the 2nd circuit board of the above projects in the opposite direction mutually is used. The effect which can simplify connection with the circuit included in each terminal and each substrate of this control device is acquired by arranging a control device among both substrates, where it turned that energization terminal to the circuit board side of the above 1st and the above-mentioned control terminal is turned to the circuit board side of the above 2nd.

[0081] Moreover, if radiator material with larger surface area than this radiator is connected with the radiator of the above-mentioned control device, the effect which can promote the thermolysis from this control device further will be acquired.

[0082] While installing two or more control devices between the 1st circuit board of the above, and the 2nd circuit board. According to what connected with the radiator of these control device the common radiator material prolonged in the 2nd circuit board of the above, and abbreviation parallel. While being able to introduce the radiator material of a large area, without making the whole electric junction box enlarge and being able to promote the part thermolysis operation further, using effectively the space inserted into both substrates, the effect which can also reduce components mark is acquired.

Furthermore, since the above-mentioned radiator material will be in a wrap condition from one side about the 2nd circuit board of the above, the effect that the control circuit in the 2nd circuit board can be effectively protected from an electromagnetic wave is also acquired by making this radiator material serve a double purpose as shield material of the 2nd circuit board.

[0083] If a cooling element is made to intervene between the above-mentioned radiator material and the radiator of the above-mentioned control device and it is made to carry out heat transfer compulsorily towards radiator material from the above-mentioned radiator, the thermolysis from a radiator will be promoted further and the effect that the fault temperature up of a control device can be prevented still more certainly will be acquired.

[0084] Furthermore, if the cooling control section which controls actuation of the above-mentioned cooling element based on the temperature detected by this temperature detection means includes in the 2nd circuit board of the above while having a temperature detection means detect the temperature of the above-mentioned control device, or the temperature corresponding to this, the effect which can perform the proper temperature control which balanced the actual condition, using this control circuit effectively will be acquired.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the connector and electric junction box which are used for the wire harness for automobiles etc.

[0002]

[Description of the Prior Art] An example of the circuitry in the conventional electric junction box is shown in drawing 17. In drawing, the bus bar substrate (the 1st circuit board) 90 and the electronic-circuitry substrate (the 2nd circuit board) 92 are arranged on abbreviation parallel, and the connector 94 is interposed between both the substrates 90 and 92 comrades.

[0003] A power circuit etc. is connected to the bus bar circuit (current circuit) included in the bus bar substrate 90 through the electric wire of **** etc., and comparatively big current is passed by this bus bar circuit in it. On the electronic-circuitry substrate 92, FET (field-effect transistor) 96, the gate signal input circuit which inputs a gate signal (control signal) into the gate terminal of this FET 96 are carried. And the energization terminal (a source terminal and drain terminal) of the above FET 96 is connected to the above-mentioned bus bar circuit through the flow section in the above-mentioned connector 94, and the current which flows the above-mentioned bus bar circuit is controlled by the gate signal inputted into this FET 96.

[0004] Thus, although current equivalent to the current which flows a bus bar circuit is passed between the source drains of the above FET 96, this current is remarkably large compared with the current which flows the control circuit of the electronic-circuitry substrate 92, and, therefore, the calorific value of FET 96 becomes very large compared with the electron device mounted on the same electronic-circuitry substrate 92. Then, while carrying out exposing some energization terminals on the surface of FET 96 etc. that this FET 96 should be cooled effectively and forming a radiator conventionally, means like the illustration to this radiator to connect the heat sink 98 of a large area comparatively are taken.

[0005]

[Problem(s) to be Solved by the Invention] With the above-mentioned configuration, since FET 96 is directly mounted on the circuit board 92, propagation and a possibility of doing a bad influence at actuation of these devices are in other electron devices with which the heat released out of FET 96 was mounted on the same electronic-circuitry substrate 92.

[0006] This invention aims at offering the connector and electric junction box which can protect other electron devices from thermolysis of control devices including FET effectively in view of such a situation.

[0007]

[Means for Solving the Problem] As above-mentioned The means for solving a technical problem, this invention incorporates at one the 1st connection material for connecting a control device and this control device for controlling current which flows a current circuit in the above-mentioned current circuit, and the 2nd connection material for connecting the above-mentioned control device to a control circuit which controls actuation of this device in connector housing.

[0008] According to this connector, while connecting that control device to a current circuit through the 1st connection material, current of a current circuit is controllable by this control device, controlling actuation of a control device by this control circuit by connecting the above-mentioned control device to a control circuit through the 2nd connection material. In this condition, since it is in a location where the above-mentioned control device separated from the above-mentioned control circuit, it prevents telling heat released out of a control device directly to other electron devices on the above-mentioned control board etc. unlike structure of mounting the above-mentioned control device on a control board like before.

[0009] In this connector, if a radiator is formed in the above-mentioned control device and this radiator is exposed to the exterior of the above-mentioned connector housing, heat can be more efficiently radiated in heat with which a control device emits a control device compared with structure conventionally which is mounted on a control board, and that fault temperature up can be prevented.

[0010] Moreover, if radiator material which has bigger surface area than a radiator of the above-mentioned control device is connected with the radiator concerned and this radiator material is exposed to the exterior of the above-mentioned connector housing, a thermolysis operation from this control device will be raised further.

[0011] Although the above-mentioned radiator material may be directly contacted to a radiator of the above-mentioned control device, if a cooling element which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator among these is made to intervene, thermolysis from a radiator can be promoted further.

[0012] Furthermore, when connection material for cooling which connects the above-mentioned cooling element to a control circuit of the 2nd circuit board of the above is included in one and a cooling element and a control circuit were connected to the above-mentioned connector housing through this connection material for cooling, it was also able to be said that actuation of a cooling element was controlled using this control circuit.

[0013] As for connection material of the above 1st, and the 2nd connection material, it is desirable that these have turned to an opposite direction mutually. Thereby, an activity which connects a control device to both sides of a current circuit and a control circuit becomes easy, and wiring structure also becomes easy.

[0014] It can avoid more certainly that energization terminals short-circuit by making a separator which consists of an insulating material intervene among the above-mentioned energization terminals in that case.

[0015] Moreover, this invention is the electric junction box which arranged the above-mentioned control device in a location between the 1st circuit board of the above, and the 2nd circuit board while being equipped with the 1st circuit board in which a current circuit was included, a control device for controlling current which flows the above-mentioned current circuit, and the 2nd circuit board in which a control circuit which controls actuation of this control device was included.

[0016] In this configuration, since a semiconductor device is arranged among both substrates, compared with structure, it is easy to radiate heat from a semiconductor device conventionally by which this semiconductor device is mounted on the 2nd circuit board, and that fault temperature up is avoided. Moreover, telling heat released out of this semiconductor device directly to an electron device of the 2nd circuit board etc. can also be prevented. And since a semiconductor device is originally arranged among both substrates that are carrying out mutual alienation, it does not need to enlarge the whole electric junction box, and connection between a semiconductor device and both substrates is also easy for it.

[0017] especially -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation -- as the above-mentioned semiconductor device, when making it estrange mutually and arranging in the parallel condition If that to which a control terminal connected with two or more energization terminals connected to a current circuit of the 1st circuit board of the above in a control circuit of the 2nd circuit board of the above projects in the opposite direction mutually is used Connection with a circuit included in each terminal and each substrate of this semiconductor device can be simply performed by arranging a semiconductor device among both substrates, where it turned that energization terminal to a circuit

board side of the above 1st and the above-mentioned control terminal is turned to a circuit board side of the above 2nd.

[0018] Moreover, if radiator material with larger surface area than this radiator is connected with a radiator of the above-mentioned semiconductor device, a thermolysis operation from this semiconductor device will be raised further.

[0019] Although neither a configuration of this radiator material nor especially arrangement is asked, while installing two or more semiconductor devices between the 1st circuit board of the above, and the 2nd circuit board If common radiator material prolonged in the 2nd circuit board of the above and abbreviation parallel is connected with a radiator of these semiconductor devices, using effectively space inserted into both substrates, radiator material of a large area can be introduced without making the whole electric junction box enlarge, and the part thermolysis operation can be promoted further.

Moreover, since thermolysis of two or more semiconductor devices by common radiator material can be promoted, components mark are also reduced compared with a case where radiator material is allotted for every semiconductor device. Furthermore, since the above-mentioned radiator material will be in a wrap condition from one side about the 2nd circuit board of the above, it also becomes possible to make this radiator material serve a double purpose as shield material of the 2nd circuit board.

[0020] Although the above-mentioned radiator material may be directly contacted to a radiator of the above-mentioned semiconductor device, if a cooling element which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator among these is made to intervene, thermolysis from a radiator can be promoted further.

[0021] Although un-arranging [that dew condensation occurs on the surface of this semiconductor device] may arise here when cooling of a semiconductor device is unnecessary (at for example, the time of un-operating), it carries out that a cooling element operates etc. and a semiconductor device is supercooled Like a Peltier device, by supply current from the outside etc., when the above-mentioned cooling element is an element in which actuation control is possible, while it is equipped with a temperature detection means to detect temperature of the above-mentioned semiconductor device, or temperature corresponding to this By including a cooling control section which controls actuation of the above-mentioned cooling element based on temperature detected by this temperature detection means in the 2nd circuit board of the above, proper temperature control corresponding to the actual condition can be performed.

[0022] Although you may make it arrange the above-mentioned semiconductor device among both substrates independently, said each connector is used, i.e., assembly operation of the whole electric junction box becomes easy by connecting the above-mentioned current circuit to the 1st connection material of this connector, and connecting the above-mentioned control circuit to the 2nd connection material of the above-mentioned connector.

[0023]

[Embodiment of the Invention] The gestalt of operation of the 1st of this invention is explained based on drawing 1 - drawing 7.

[0024] The electric junction box 10 shown in drawing 1 is equipped with the lower case 11 and the upper case 12. Engagement section 11b is formed in side wall 11a of a lower case 11, engagement section 12b is formed in side wall 12a of an upper case 12, and both the cases 11 and the connection condition of 12 comrades are held by engagement of both engagement section 11b and 12b.

[0025] The bus bar substrate 13 is arranged on the above-mentioned lower case 11. Much tab 13a has started from this bus bar substrate 13 to the upper part. A power circuit etc. is connected to the bus bar circuit (current circuit) included in this bus bar substrate 13 through the electric wire of **** etc., and comparatively big current is passed by this bus bar circuit in it.

[0026] Rather than the above-mentioned bus bar substrate 13, two or more stanchion 11c which projects up further is set up by the periphery section of a lower case 11, and the electronic-circuitry substrate 14 is supported by such stanchion 11c. namely, this electronic-circuitry substrate 14 -- the above-mentioned bus bar substrate 13 and abbreviation -- it is in an parallel condition and is supported by the location estranged from this bus bar substrate to the upper part. Many electron devices 15 are mounted in this

electronic-circuitry substrate 14, and the control circuit which inputs a gate signal into below-mentioned FET18 with these electron devices 15 is constituted.

[0027] And the connector 16 as shown in drawing 2 - drawing 6 is interposed between this electronic-circuitry substrate 14 and the above-mentioned bus bar substrate 13. This connector 16 is equipped with the above FET 18 and the gate splicing fitting (2nd connection material) 20 which are a control device, the drain splicing fitting (1st connection material) 21, the source splicing fitting (2nd connection material) 22, and a heat sink 24, and these whole is included in the connector housing 26 made of resin by one with mold shaping.

[0028] The connector housing 26 is prolonged in the periphery section of the electronic-circuitry substrate 14, and parallel, and the upper limit section is crooked in the electronic-circuitry substrate 14 side. a part for and this flection -- the two forks in which the side to the plug of the periphery section of the above-mentioned electronic-circuitry substrate 14 is possible -- clip section 26a of a ** is formed.

[0029] The semiconductor chip 28 which is an FET main part, a gate terminal (control terminal) 30, the drain terminal (energization terminal) 31, and the source terminal (energization terminal) 32 are covered with the housing 34 made of resin, and FET18 can be manufactured with mold shaping etc., as shown in drawing 7 (a) - (c).

[0030] The above-mentioned gate terminal 30 and the source terminal 32 are joined by the side (drawing 7 (b) right lateral) of the same side in the above-mentioned semiconductor chip 28, and the above-mentioned drain terminal 31 is connected to the side of this and the opposite side. The portion joined by the above-mentioned side in this drain terminal 31 is set to radiator 31a which has an area equivalent to the side concerned, and this radiator 31a has exposed it to the side of the above-mentioned housing 34.

[0031] Furthermore, as a feature of this FET18, among the three above-mentioned terminals 30-32, only the gate terminal 30 was prolonged in the upper part from the above-mentioned semiconductor chip 28, and it has projected from the upper surface of housing 34 to the upper part, and remaining drain terminals 31 and source terminals 32 were caudad prolonged in abbreviation parallel in the condition of having ranked with right and left mutually, and are caudad projected from the inferior surface of tongue of housing 34 in it, respectively.

[0032] The gate splicing fitting 20 is arranged on the upper part of a connector 16, and the lower limit of this gate splicing fitting 20 is connected with the gate terminal of the above FET 18. the upper part of this gate splicing fitting 22 -- the side -- being crooked -- a part for that point -- clip section 26a of the above-mentioned connector housing 26 -- the same -- the two forks (namely, the side to a plug is possible for the electronic-circuitry substrate 14) which can pinch the periphery section of the above-mentioned electronic-circuitry substrate 14 from the upper and lower sides -- clip section 20a of a ** is formed. and the conductor which constitutes the control circuit of this electronic-circuitry substrate 14 after this clip 20a has pinched the periphery section of the electronic-circuitry substrate 14 -- partial 14a contacts the above-mentioned clip section 20a, and the above-mentioned control circuit is electrically connected to the gate terminal 30 of FET18 through the gate splicing fitting 20.

[0033] The drain splicing fitting 21 and the source splicing fitting 22 are making mutually the same configuration and the configuration which is specifically prolonged up and down and has the engagement section of a female mold to the vertical both ends, the lower limit section of the drain terminal 31 of the above FET 18 is inserted in the upper limit section of the drain splicing fitting 21, and the lower limit section of the source terminal 32 is inserted in the upper limit section of the source terminal 22.

[0034] Between both the splicing fitting 21 and 22 comrades, the separator 36 which consists of an insulating material intervenes. The whole is unified by mold shaping and, as for these splicing fitting 21 and 22 and a separator 36, the insulation of both the splicing fitting 21 and 22 comrades is secured by mediation of this separator 36. And these tab 13a is connected to the above-mentioned drain terminal 31 and the source terminal 32 according to an individual through each splicing fitting 21 and 22 by inserting suitable tab 13a in the above-mentioned bus bar substrate 13 in the lower limit section of both the splicing fitting 21 and 22 from a lower part. That is, FET18 is incorporated all over a bus bar circuit.

[0035] A heat sink 24 is fabricated with the material excellent in conductivity, such as aluminum, and has the configuration prolonged at a horizontal to the size of the connector housing 26 and an abbreviation EQC. And after the surface of this heat sink 24 has been exposed to the lateral surface (the side of the electronic-circuitry substrate 14 and the opposite side; drawing 2 right lateral) of the connector housing 26, this heat sink 24 is also included in the connector housing 26. Protruding line 24a of a large number prolonged horizontally is formed in the surface of this heat sink 24, and, thereby, the heat sinking plane product of a heat sink 24 is increased.

[0036] Crevice 24b is formed in the medial surface of this heat sink 24, and by inserting in this crevice 24b one flank (flank of the side which radiator 31 of drain terminal 31a has specifically exposed) of the housing 34 of FET18, after radiator 31a of FET18 and a heat sink 24 have contacted, these FET18 and a heat sink 24 are combined with one.

[0037] Next, an operation of this electric junction box 10 is explained.

[0038] There are some bus bar circuits which were included in the bus bar substrate 13 and into which comparatively big current is inputted through the electric wire of **** etc. The middle, the comparatively big current passed in this circuit flows in order of source terminal 32 -> semiconductor chip 28 -> drain terminal 31 -> drain splicing fitting 21 -> tab 13a of tab 13a -> source splicing fitting 22 -> FET18 shown in drawing 2 - drawing 6, and is outputted from a bus bar circuit. On the other hand, a gate signal is inputted into the gate terminal 30 of the above FET 18 through the gate splicing fitting 20 from the control circuit included in the electronic-circuitry substrate 14, and the amount of energization between the source-drains in the above FET 18 is controlled by this gate signal.

[0039] Thus, since current equivalent to the current which flows a bus bar circuit flows to FET18, pyrexia takes place to FET18. Since FET18 was conventionally mounted on the electronic-circuitry substrate 14 with other electron devices here, Although sufficient thermolysis operation had a possibility that the heat which is hard to be obtained and this FET18 emits might get across to other electron devices, and might have a bad influence also on the engine performance of these electron devices even if it connected the heat sink etc. with this FET18 With the electric junction box 10 shown in drawing 1 - drawing 7, after FET18 has separated from the both sides of the bus bar substrate 13 and the electronic-circuitry substrate 14, it is allotted to the location between both the substrates 13 and 14 comrades. Since the heat sink 24 in contact with radiator 31a of FET18 is in the condition of having exposed to the way outside the connector housing 26, a thermolysis operation of this FET18 is high, and it can prevent that released heat having a bad influence on each electron device on the electronic-circuitry substrate 14. And since both the substrates 13 and 14 are arranged in the condition of having estranged mutually from the first, although FET18 is arranged among these, it is not necessary to enlarge especially the electric junction box 10.

[0040] The gestalt of the 2nd operation is shown in drawing 8. Although the heat sink 24 which turned radiator 31a of FET18 to the lateral surface of a connector 16, and was connected with this radiator 31a is exposed to the above-mentioned lateral surface with the gestalt of said 1st operation, with the gestalt of this 2nd operation, the above-mentioned radiator 31a was turned to the medial surface of a connector 16, and the heat sink 24 connected with this heat sink 31a is turned to the above-mentioned medial surface.

[0041] Thus, what is necessary is to have not asked concrete arrangement of the radiator material of heat sink 24 grade, but just to fully have exposed it from the connector housing 26 in this invention.

[0042] The gestalt of the 3rd operation is shown in drawing 9. Here, the both ends of the electronic-circuitry substrate 14 are connected with the bus bar substrate 13 through the connector 16. That is, two connectors 16 are arranged in the condition of carrying out phase opposite, between the electronic-circuitry substrate 14 and the bus bar substrate 13. And radiator 31a of FET18 included in each connector 16 is directly exposed to the field (medial surface) which counters mutually in each connector 16, and the single heat sink 38 is connected with it at these radiator 31a. namely, this heat sink 38 -- between the bus bar substrate 13 and the electronic-circuitry substrates 14 -- these and abbreviation -- it is allotted in the parallel condition and intervenes among radiator 31a of both the connectors 16. moreover -- the inferior surface of tongue of this heat sink 38 -- many -- fin of several sheets 38a is

formed and, thereby, the increment in a heat sinking plane product is achieved.

[0043] According to such a configuration, in addition to the effect acquired with the gestalt of said the 1st and 2nd operation, the following effects can be acquired.

[0044] ** The heat sink 38 of a large area can be arranged by using effectively the space inserted into the bus bar substrate 13 and the electronic-circuitry substrate 14, without enlarging the electric junction box 10 whole. Therefore, though it is compact structure, the outstanding thermolysis operation can be acquired.

[0045] ** By the common heat sink 38, the thermolysis from FET18 in two or more connectors 16 can be promoted, and components mark can be reduced.

[0046] ** By the metal heat sink 38, since the inferior surface of tongue of the electronic-circuitry substrate 14 can be mostly covered over the whole region, this heat sink 38 can be made to serve a double purpose as shield material, and, thereby, can protect the electronic-circuitry substrate 14 from an electromagnetic wave effectively. Furthermore, a shielding effect will become thoroughgoing, if a metal plate is arranged also on said upper case 12 and the electronic-circuitry substrate 14 is covered with a metal plate also from the upper part.

[0047] Next, the gestalt of the 4th operation is explained based on drawing 10 - drawing 12.

[0048] With the gestalt of this operation, Peltier device (cooling element) 40 is interposed between radiator 31a of FET18, and a heat sink 24 in the connector 16 shown with the gestalt of said 1st operation. This Peltier device 40 is equipped with the terminal of a pair, and in connection with current being passed among these terminals, it is a degree corresponding to the magnitude of this current, and it is constituted so that heat transfer may be made to start in the direction which goes to a heat sink 24 from above-mentioned radiator 31a compulsorily.

[0049] On the other hand, the temperature sensor (temperature detection means) 42 as shown in drawing 12 is built into said FET18. This temperature sensor 42 consists of a thermocouple etc., and it is constituted so that the electrical signal equivalent to the exoergic temperature of FET18 may be outputted.

[0050] As shown in drawing 11, the splicing fitting 50A and 50B for cooling (connection material for cooling) and the splicing fitting 52 for detection (connection material for detection) of a pair of a configuration (namely, configuration which has the clip section whose electronic-circuitry substrate 14 is pinched) equivalent to this gate splicing fitting 20 are built into the upper part of a connector 16 in the condition of standing in a line at a level with said gate splicing fitting 20. Each terminal of said Peltier device 40 is connected to each splicing fitting 50A and 50B for cooling through the wiring in a connector of ****, and the output terminal of the above-mentioned temperature sensor 42 is connected to the splicing fitting 52 for detection. And the above-mentioned gate terminal 30, the both-ends child of Peltier device 40, and the output terminal of a temperature sensor 42 are connected concurrently to the control circuit included in this electronic-circuitry substrate 14 by inserting the periphery section proper place of the electronic-circuitry substrate 14 in the clip section of each above-mentioned splicing fitting 20, 50A, 50B, and 52 at coincidence.

[0051] The control circuit included in the above-mentioned electronic-circuitry substrate 14 is equipped with the temperature data analysis section 44 and the current controller 46 as shown in drawing 12 besides the above-mentioned gate signal generating section, and the warning command section 48.

[0052] The temperature data analysis section 44 is constituted so that the temperature data inputted from a temperature sensor 42 is analyzed, the control signal corresponding to the temperature may be outputted to the current controller 46 when detection temperature is beyond the 1st decision value, and a warning control signal may be outputted at the warning command section 48 in beyond the 2nd decision value with a detection temperature higher than the 1st decision value of the above.

[0053] The current controller 46 passes the current corresponding to this control signal among the both-ends children of Peltier device 40, when a control signal is inputted from the above-mentioned temperature data analysis section 44. That is, this current controller 46 is constituted so that such big current that that temperature is high when the above-mentioned detection temperature is more than fixed may be passed among the both-ends children of Peltier device 40. Moreover, when a control signal is

inputted from the above-mentioned temperature data analysis section 44, the warning command section 48 outputs a command signal to the warning means of **** formed in the electric junction box exterior, and it is constituted so that it may be made to warn.

[0054] If pyrexia of FET18 becomes remarkable, since according to such a configuration between the both-ends children of Peltier device 40 will energize, Peltier device 40 will operate and the compulsory heat transfer from FET18 to a heat sink 40 will be caused, the thermolysis to the open air which leads a heat sink 24 from FET18 by this is promoted, and the extremes-of-temperature rise of FET18 is avoided. moreover, since actuation of Peltier device 40 is suspended when the temperature of FET18 is comparatively low, it is based on the supercooling of FET18 -- being also inconvenient (for example, generating of dew condensation) -- it can protect.

[0055] In addition, you may make it the temperature set as the object of detection detect not only exoergic temperature of the above own [FET18] but its ambient temperature, and the temperature of the gate splicing fitting 20 in the gestalt of this operation. Moreover, the temperature of the elevated-temperature side (drawing 11 drawing 10 and left lateral) of Peltier device 40 is detected, and if energization of Peltier device 40 is stopped when this temperature rises too much, failure of Peltier device 40 self can also be prevented.

[0056] Moreover, you may make it make Peltier device 40 intervene, respectively between both the connectors 16 shown with the gestalt of said 3rd operation, and the both ends of a heat sink 38, as the connector 16 which can introduce this Peltier device 40 is not restricted to what was shown in the gestalt of said 1st operation, for example, is shown in drawing 13 as a gestalt of the 5th operation.

[0057] The gestalt of the 6th operation is shown in drawing 14 (a) and (b). although said each operation gestalt showed what used the connector 16 incorporating this for connection within an electric junction box, using FET as a control device, while using the connector 16 which incorporated IPS (Intelligent Power Switch) as a control device with the gestalt of this operation -- this connector 16 -- the inside of an electric junction box -- setting -- coming out -- there is nothing, direct continuation is carried out to a power supply and a load, and it is made to perform that flow control.

[0058] Above IPS has the power section 60 and the intelligent section 62. In the power section 60, the switching element which consists of FET etc., an internal electrical power source, a thermo-sensitive device, etc. are incorporated. The intelligent section 62 consisted of logical circuits etc., and is equipped with the function to judge the existence of abnormalities based on detecting signals, such as the above-mentioned thermo-sensitive device, the function to perform on-off control of the above-mentioned switching element based on the command inputted from an external control circuit, etc.

[0059] A grounding terminal 63, the input terminal 64 into which the above-mentioned command is inputted, and the diagnostic-output terminal 65 for outputting an abnormality diagnostic signal to the above-mentioned control circuit are formed in the intelligent section 62, and these terminals are equipped with splicing fitting 68. On the other hand, a power supply terminal 67 and an output terminal 66 are formed in the above-mentioned power section 60, a power supply terminal 67 is equipped with splicing fitting 77, and the output terminal 66 is equipped with splicing fitting 76. And mold shaping of the connector housing 70 is carried out on the outside that these whole should be unified, and the connector 16 is constituted. While the above-mentioned input terminal 64 and the diagnostic-output terminal 65 are connected to the above-mentioned control circuit through splicing fitting (2nd connection material) 68, respectively A power supply terminal 67 is connected to a power supply through splicing fitting (1st connection material) 77, and the output terminal 66 is connected to the load through splicing fitting (1st connection material) 76.

[0060] Even if it uses such a connector 16, energization between power supply-loads can be turned on and off by actuation of IPS which is a control device, and actuation of this IPS can be controlled by the control circuit. And efficient thermolysis can be performed by making IPS estrange from this control circuit by being able to protect the circuit element of a control circuit and exposing the power supply terminal 67 of Above IPS on the external surface of the connector housing 70. Furthermore, the thermolysis effect can be heightened by introducing a heat sink and a suitable cooling element like the above.

[0061] Moreover, when Above IPS builds in two or more switching elements (i.e., as shown in drawing 15 (a) and (b) as a gestalt of the 7th operation, also when it has two or more input terminals 64 and output terminals 66), the connector 16 with which the whole was united like the gestalt of implementation of said 6th operation can be constituted.

[0062] In addition, you may make it the connector of this invention connect the 1st [as shown in said drawing 2 , not only when carrying out direct continuation to the bus bar substrate 13 and the electronic-circuitry substrate 14, but] connection material to a current circuit through an electric wire, and may make it connect the 2nd connection material to a control circuit through an electric wire. For example, you may make it connect to splicing fitting 68 and splicing fitting 76 and 77 the cable terminal and connector which were prepared in the terminal of the above-mentioned electric wire in the case of the connector 16 shown in drawing 14 (a) and (b).

[0063] Thus, since the arrangement location of a connector can be freely set to the structure which connected the connector of this invention to the current circuit and the control circuit through the electric wire, respectively, when thermolysis of the electron device inserted especially in the interior of a connector is remarkable, the advantage which can prevent the thermal run away of the above-mentioned electron device is acquired by installing only a part for a connector area in the location where environmental temperature is low.

[0064] On the other hand, if the wiring gestalt which carries out direct continuation of the 1st connection material of the connector of this invention to the load or power supply terminal, and connects the 2nd connection material of the connector of this invention to a current circuit side through an electric wire at a control circuit side is taken It is possible to be able to carry out [shortest]-izing of the path for which it flows, the path, i.e., the high current, between a current circuit and the connector of this invention, to abolish the necessity of arranging the large diameter electric wire for high currents on this path, and to reduce cost remarkably, making a current circuit estrange greatly from the above-mentioned control circuit comparatively weak with heat. Moreover, the noise which comes out of the above-mentioned high current path can be prevented using the minimum cutoff material.

[0065] Moreover, to a current circuit, the 1st connection material of the connector of this invention is connected to reverse through an electric wire, and when it can be made to carry out to the connector for substrates of the circuit board in which the control circuit was included etc. direct continuation of the 2nd connection material, the advantage which can combine the connector of this invention with the above-mentioned connector for substrates etc. easily is acquired, making a control circuit and a current circuit estrange greatly. Moreover, since a high current does not flow the above-mentioned circuit board top, the temperature rise of the substrate concerned and generating of a radiation noise can be prevented, and the advantage which can prevent malfunction of the control circuit included in this substrate is acquired.

[0066] Although various methods of manufacturing a connector 16 in this invention are considered, the example is shown in drawing 16 (a) - (c).

[0067] First, as shown in drawing 16 (a), while manufacturing what equipped the power section 60 of IPS with the power supply terminal 67 and the output terminal 66, as shown in this drawing (b), mold shaping of the connector housing 72 with which the splicing fitting 73 for grounding terminals, the splicing fitting 74 for diagnostic-output terminals, and the splicing fitting 75 for input terminals were fixed is carried out, and what was shown by said drawing 16 (a) is fixed to crevice 72a formed in this connector housing 72. next, it is shown in this drawing (c) -- as -- each terminal of the power section 60 -- each above-mentioned splicing fitting 73, 74, and 75 -- a wire 78 -- minding -- connecting (that is, it connecting by wirebonding etc.) -- a power supply terminal 67 and an output terminal 66 are equipped with splicing fitting 77 and 76, respectively. And a connector can be completed by putting a lid for a part for a connection with the above-mentioned wire 78 on the connector housing 72 from a top a cover and if needed by resin mold etc. at least.

[0068] This invention can also take the following gestalten as an example besides the gestalt of the above-mentioned operation.

[0069] (1) In the gestalt of said 1st operation etc., it is also possible to interpose between both the

substrates 13 and 14 comrades in the condition of having omitted the connector housing 26 and having made the full exposure of FET18 carrying out outside. The thermolysis effect can be promoted by connecting the radiator material of heat sink 24 grade with the radiator of FET18 also in this case, or making Peltier device 40 intervene between this radiator material and FET18. However, like said each operation gestalt, if the above FET 18 is unified as a single connector 16 with each splicing fitting 20-22, the advantage which can carry out [easy]-izing of the assembly operation of the electric junction box 10 whole will be acquired.

[0070] (2) In addition to this, the control device in this invention can apply IGBT (Insulated Gate Bipolar Transistor), BPT (Bipolar Transistor), various regulators, a power module, etc. not only in the above [FET or IPS] 18. However, if the control device with which a control terminal (the example of drawing gate terminal 30) and an energization terminal (the example of drawing the drain terminal 31 and the source terminal 32) project in an opposite side mutually is used as shown in said each operation gestalt The advantage which can simplify connection structure is acquired by interposing this control device between both the substrates 13 and 14 in the condition that the above-mentioned energization terminal turns to the above-mentioned bus bar substrate 13 side (the example of drawing under), and the sense and a control terminal turn to the electronic-circuitry substrate 14 side (above).

[0071] (3) The 1st circuit board in this invention can apply the various circuit boards by which the conductor was built into the substrate which consists not only of the above bus bar substrates 13 but of an insulating material.

[0072]

[Effect of the Invention] A control device for this invention to control the current which flows a current circuit as mentioned above, The 1st connection material for connecting this control device to the above-mentioned current circuit, Since it is the connector which incorporated at one the 2nd connection material for connecting the above-mentioned control device to the control circuit which controls actuation of this device in connector housing It is effective in the ability to protect other electron devices which constitute the above-mentioned control circuit from thermolysis of a control device, controlling the current in a current circuit by connecting this connector to the above-mentioned current circuit and a control circuit.

[0073] And by forming a radiator in the control device of this connector, and exposing this radiator to the exterior of the above-mentioned connector housing, the heat which a control device emits can be radiated efficiently and the effect that that fault temperature up can be prevented is acquired.

[0074] Moreover, the thermolysis effect can be made still more remarkable by connecting with the radiator concerned the radiator material which has bigger surface area than the radiator of the above-mentioned control device, and exposing this radiator material to the exterior of the above-mentioned connector housing.

[0075] Furthermore, according to the thing between which the cooling element which cools a radiator by carrying out heat transfer compulsorily towards radiator material from the above-mentioned radiator between the above-mentioned radiator material and a radiator was made to be placed, the effect that the thermolysis from a radiator can be promoted positively is acquired.

[0076] Furthermore, the effect which can control actuation of a cooling element using this control circuit is acquired by connecting a cooling element and a control circuit to the above-mentioned connector housing through this connection material for cooling according to what included in one the connection material for cooling which connects the above-mentioned cooling element to the control circuit of the 2nd circuit board of the above.

[0077] Moreover, according to that the connection material of the above 1st and the 2nd connection material have turned [that] to the opposite direction mutually, the activity which connects a control device to the both sides of a current circuit and a control circuit is done easy, and the effect which can also simplify wiring structure is acquired.

[0078] Furthermore, the effect which can be avoided more certainly is acquired [that energization terminals short-circuit and] by making the separator which consists of an insulating material intervene among the above-mentioned energization terminals.

[0079] Moreover, while this invention is equipped with the 1st circuit board in which the current circuit was included, the control device for controlling the current which flows the above-mentioned current circuit, and the 2nd circuit board in which the control circuit which controls actuation of this control device was included. Since it is the electric junction box which arranged the above-mentioned control device in the location between the 1st circuit board of the above, and the 2nd circuit board. While promoting thermolysis of a control device and being able to secure that good actuation compared with structure conventionally by which this control device is mounted on the 2nd circuit board, it is effective in the ability to prevent that the heat released out of this control device has a bad influence on the electron device of the 2nd circuit board etc. Moreover, although a control device is arranged on the location between both substrates, it is not necessary to enlarge the whole electric junction box specially, and the above-mentioned effect is acquired with compact structure, and-izing also of the connection between a control device and both substrates can be carried out [easy].

[0080] especially -- the 1st circuit board of the above, and the 2nd circuit board -- abbreviation -- as the above-mentioned control device, when making it estrange mutually and arranging in the parallel condition. If that to which the control terminal connected with two or more energization terminals connected to the current circuit of the 1st circuit board of the above in the control circuit of the 2nd circuit board of the above projects in the opposite direction mutually is used. The effect which can simplify connection with the circuit included in each terminal and each substrate of this control device is acquired by arranging a control device among both substrates, where it turned that energization terminal to the circuit board side of the above 1st and the above-mentioned control terminal is turned to the circuit board side of the above 2nd.

[0081] Moreover, if radiator material with larger surface area than this radiator is connected with the radiator of the above-mentioned control device, the effect which can promote the thermolysis from this control device further will be acquired.

[0082] While installing two or more control devices between the 1st circuit board of the above, and the 2nd circuit board. According to what connected with the radiator of these control device the common radiator material prolonged in the 2nd circuit board of the above, and abbreviation parallel. While being able to introduce the radiator material of a large area, without making the whole electric junction box enlarge and being able to promote the part thermolysis operation further, using effectively the space inserted into both substrates, the effect which can also reduce components mark is acquired. Furthermore, since the above-mentioned radiator material will be in a wrap condition from one side about the 2nd circuit board of the above, the effect that the control circuit in the 2nd circuit board can be effectively protected from an electromagnetic wave is also acquired by making this radiator material serve a double purpose as shield material of the 2nd circuit board.

[0083] If a cooling element is made to intervene between the above-mentioned radiator material and the radiator of the above-mentioned control device and it is made to carry out heat transfer compulsorily towards radiator material from the above-mentioned radiator, the thermolysis from a radiator will be promoted further and the effect that the fault temperature up of a control device can be prevented still more certainly will be acquired.

[0084] Furthermore, if the cooling control section which controls actuation of the above-mentioned cooling element based on the temperature detected by this temperature detection means includes in the 2nd circuit board of the above while having a temperature detection means detect the temperature of the above-mentioned control device, or the temperature corresponding to this, the effect which can perform the proper temperature control which balanced the actual condition, using this control circuit effectively will be acquired.

[Translation done.]

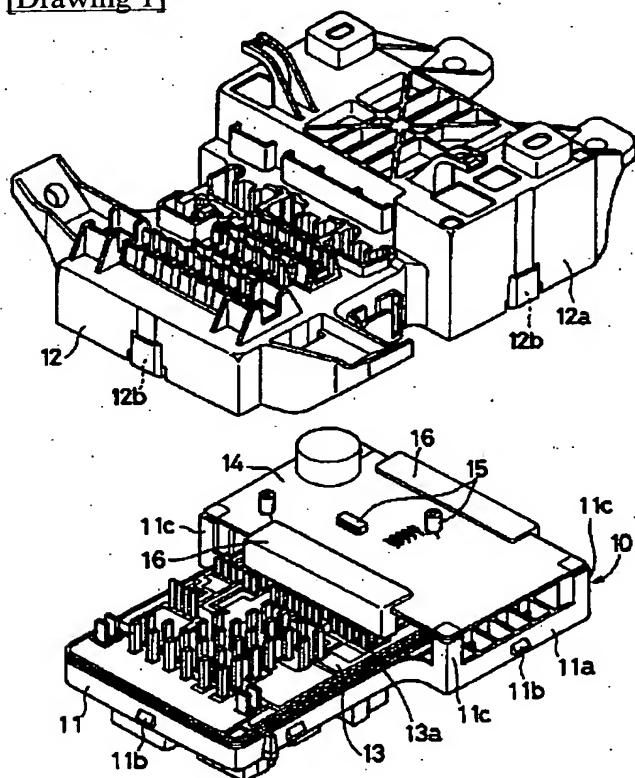
*** NOTICES ***

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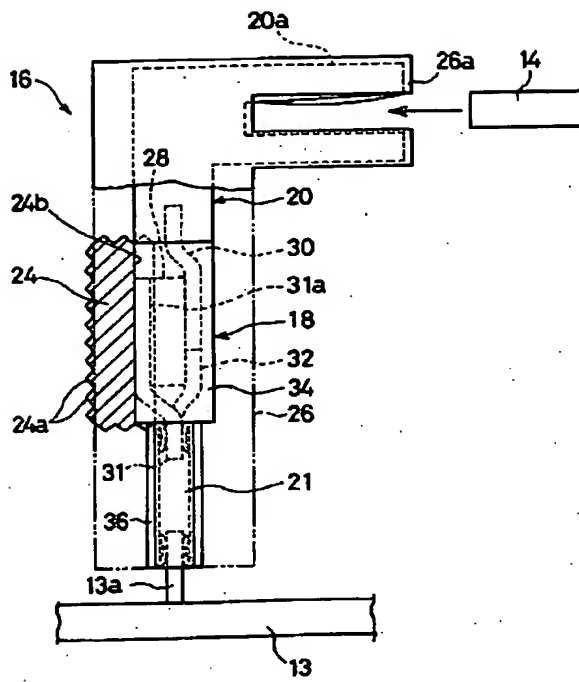
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DRAWINGS

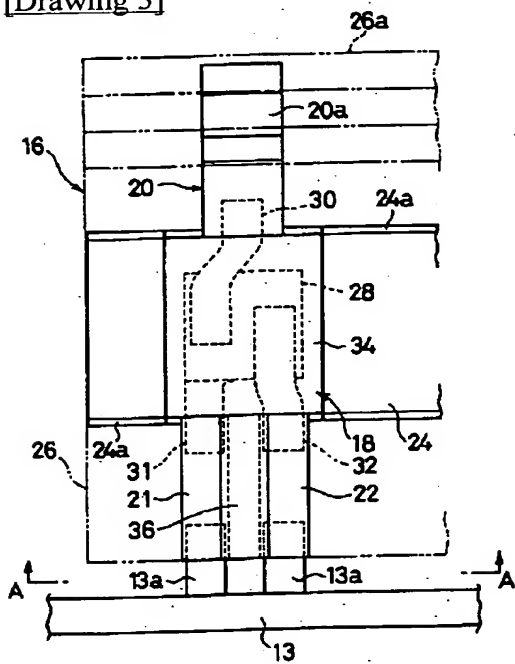
[Drawing 1]



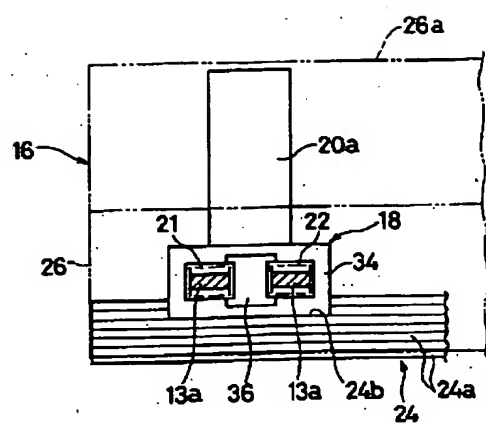
[Drawing 2]



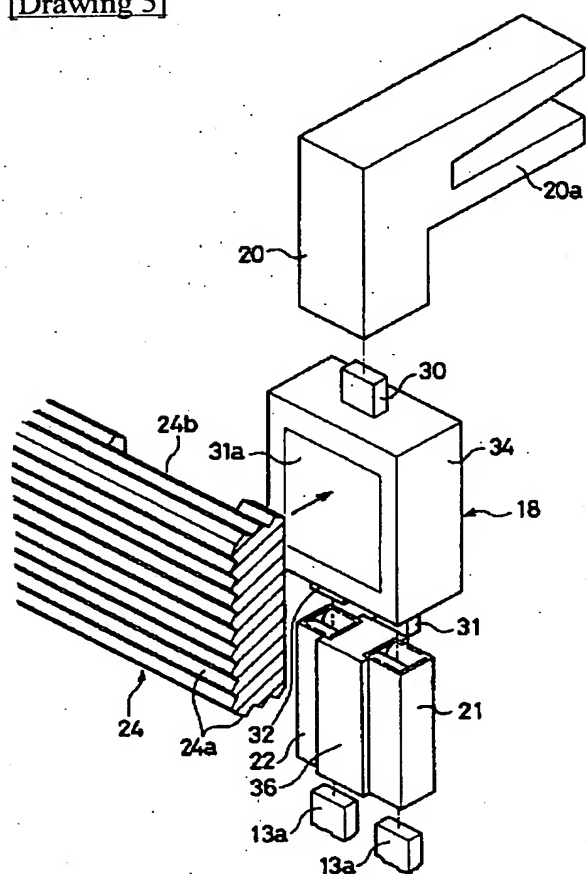
[Drawing 3]



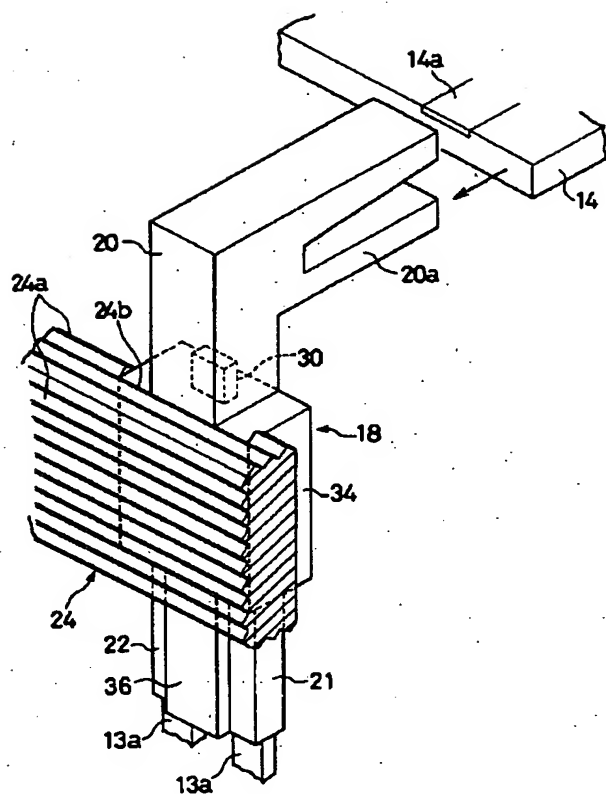
[Drawing 4]



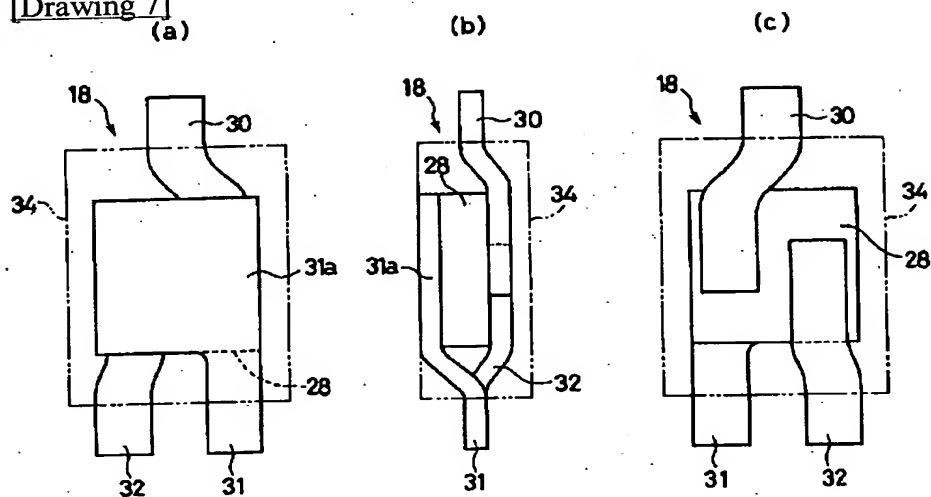
[Drawing 5]



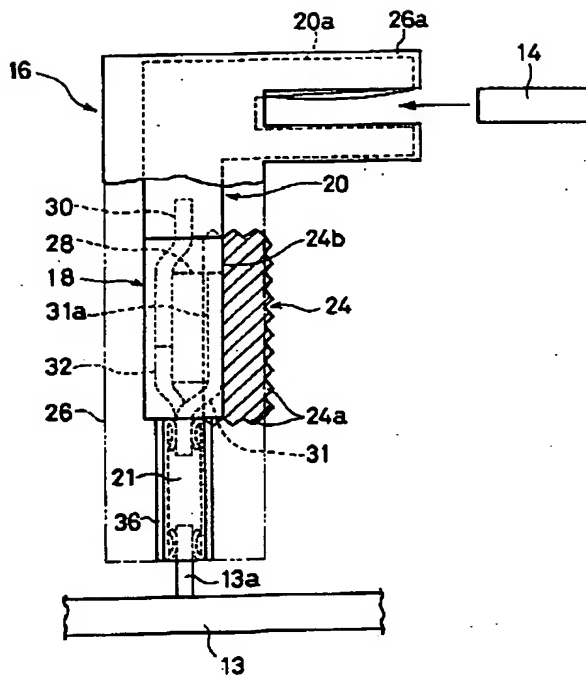
[Drawing 6]



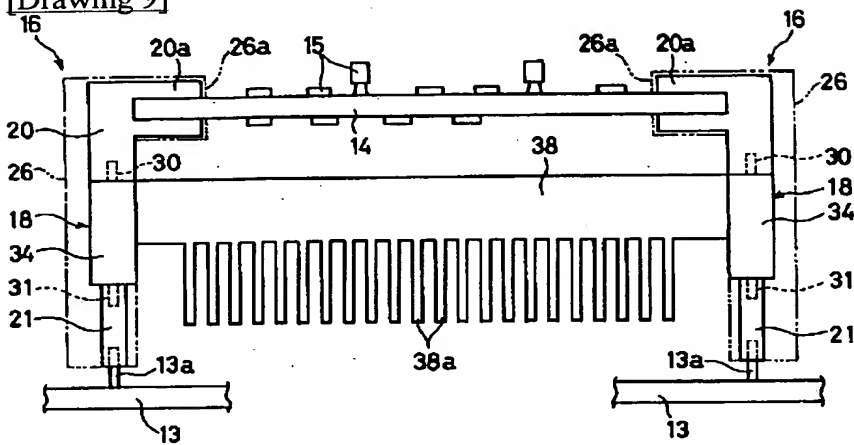
[Drawing 7]
(a)



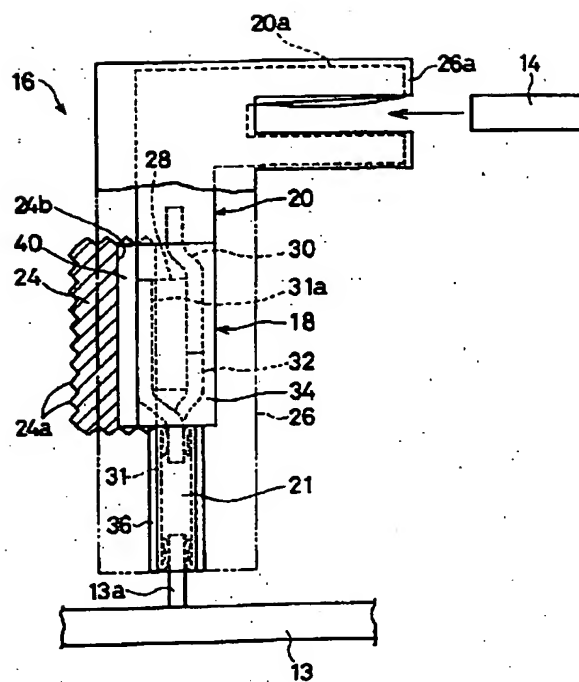
[Drawing 8]



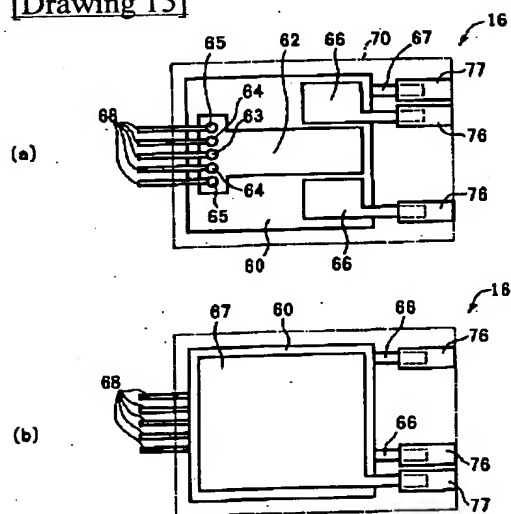
[Drawing 9]



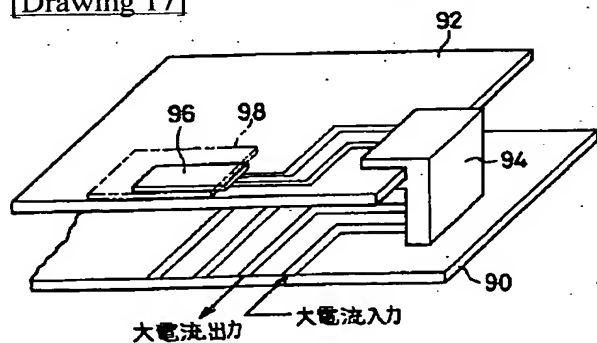
[Drawing 10]



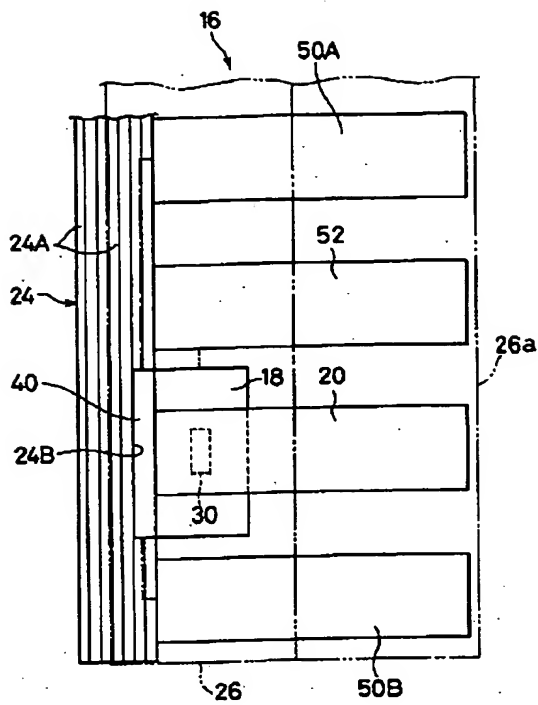
[Drawing 15]



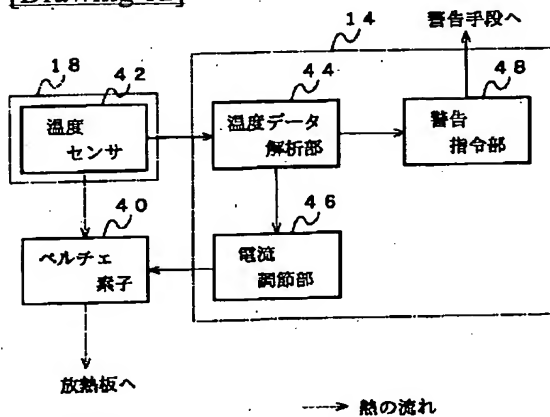
[Drawing 17]



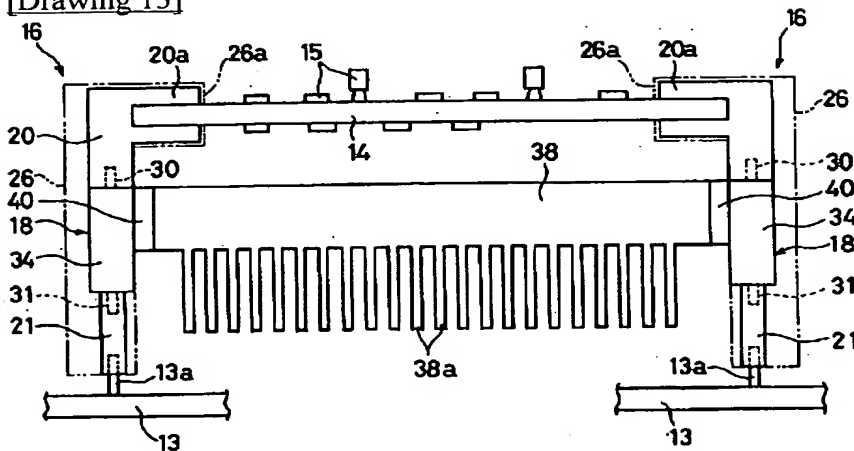
[Drawing 11]



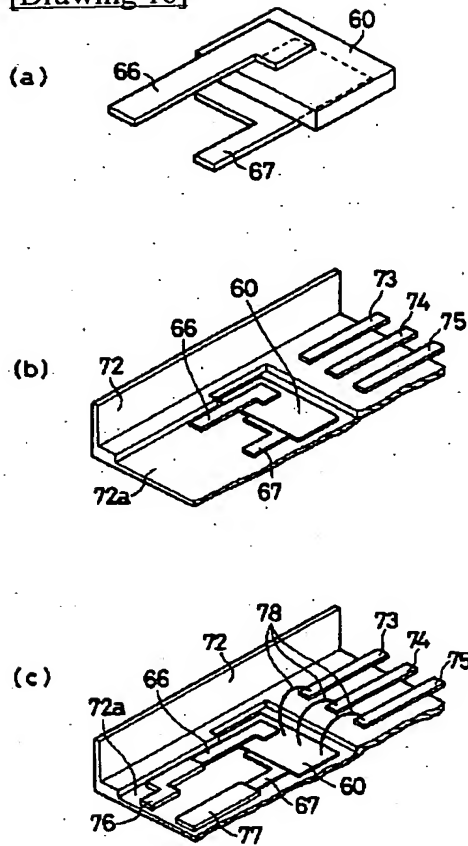
[Drawing 12]



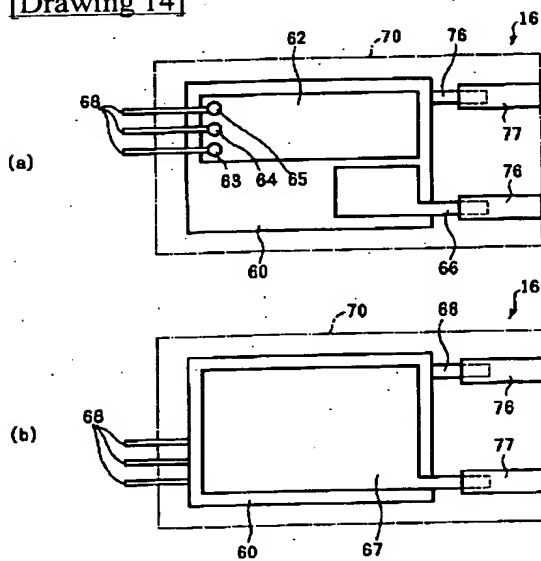
[Drawing 13]



[Drawing 16]



[Drawing 14]



[Translation done.]

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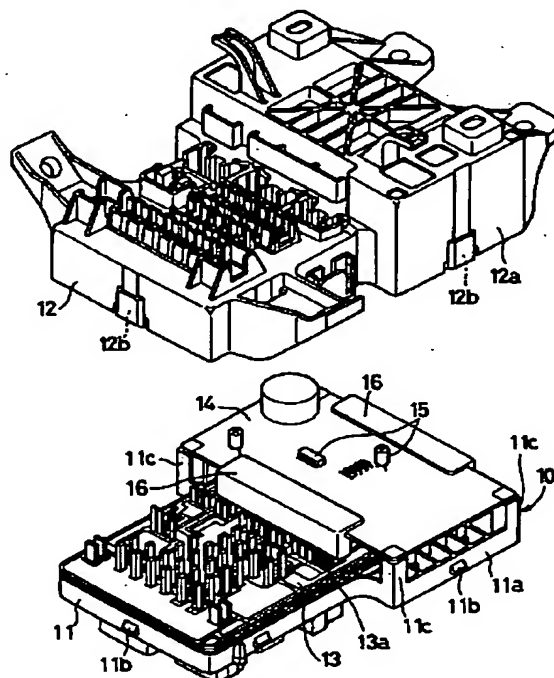
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(54) 【発明の名称】 コネクタ及び電気接続箱

(57) 【要約】

【課題】 電気接続箱等に設けられる制御デバイスの放熱から他の電子デバイスを有効に保護する。

【解決手段】 バスバー基板13と、その電流回路の電流を制御するFET18と、このFET18の作動を制御する電子回路基板14とを備え、上記FET18を両基板13、14の間に配設した電気接続箱。また、両基板13、14同士の間介設されるコネクタ16であって、上記FET18と、そのドレイン端子31等を上記バスバー基板13に接続するためのドレイン接続金具21等と、上記FET18のゲート端子21を上記電子回路基板14に接続するためのゲート接続金具20とを一体化したもの。



【特許請求の範囲】

【請求項1】 電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスを上記電流回路に接続するための第1の接続部材と、上記制御デバイスをこのデバイスの作動を制御する制御回路に接続するための第2の接続部材とをコネクタハウジング内に一体に組み込んだことを特徴とするコネクタ。

【請求項2】 請求項1記載のコネクタにおいて、上記制御デバイスに放熱部を設け、この放熱部を上記コネクタハウジングの外部に露出させたことを特徴とするコネクタ。

【請求項3】 請求項1記載のコネクタにおいて、上記制御デバイスに放熱部を設け、この放熱部よりも大きな表面積を有する放熱部材を当該放熱部に連結し、かつ、この放熱部材を上記コネクタハウジングの外部に露出させたことを特徴とするコネクタ。

【請求項4】 請求項3記載のコネクタにおいて、上記制御デバイスの放熱部と上記放熱部材との間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより上記放熱部を冷却する冷却素子を介在させたことを特徴とするコネクタ。

【請求項5】 請求項4記載のコネクタにおいて、上記コネクタハウジングに、上記冷却素子を上記第2の回路基板の制御回路に接続する冷却用接続部材を一体に組み込んだことを特徴とするコネクタ。

【請求項6】 請求項1～5のいずれかに記載のコネクタにおいて、上記第1の接続部材と第2の接続部材とが互いに反対の方向を向いていることを特徴とするコネクタ。

【請求項7】 請求項6記載のコネクタにおいて、複数の第1の接続部材同士の間絶縁材料からなるセパレータを介在させたことを特徴とするコネクタ。

【請求項8】 電流回路が組み込まれた第1の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスの作動を制御する制御回路が組み込まれた第2の回路基板とを備えるとともに、上記第1の回路基板と第2の回路基板との間の位置に上記制御デバイスを配設したことを特徴とする電気接続箱。

【請求項9】 請求項8記載の電気接続箱において、上記第1の回路基板と第2の回路基板とを略平行な状態で互いに離間させて配置するとともに、上記第1の回路基板の電流回路に接続される複数の通電端子と上記第2の回路基板の制御回路に接続される制御端子とが互いに反対の方向に突出する制御デバイスを、上記通電端子が上記第1の回路基板側に向き、上記制御端子が上記第2の回路基板側に向く状態で両基板間に配設したことを特徴とする電気接続箱。

【請求項10】 請求項8または9記載の電気接続箱において、上記制御デバイスの放熱部にこの放熱部よりも表面積の大きい放熱部材を連結したことを特徴とする電

気接続箱。

【請求項11】 請求項10記載の電気接続箱において、上記第1の回路基板と第2の回路基板との間に複数の制御デバイスを並設するとともに、これらの制御デバイスの放熱部に上記第2の回路基板と略平行に延びる共通の放熱部材を連結したことを特徴とする電気接続箱。

【請求項12】 請求項10または11記載の電気接続箱において、上記制御デバイスの放熱部と上記放熱部材との間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させたことを特徴とする電気接続箱。

【請求項13】 請求項12記載の電気接続箱において、上記制御デバイスの温度もしくはこれに対応する温度を検出する温度検出手段を備えるとともに、この温度検出手段により検出された温度に基づいて上記冷却素子の作動を制御する冷却制御部を上記第2の回路基板に組み込んだことを特徴とする電気接続箱。

【請求項14】 電流回路が組み込まれた第1の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスが組み込まれた請求項1～7のいずれかに記載のコネクタと、上記制御デバイスの作動を制御する制御回路が組み込まれた第2の回路基板とを備え、上記コネクタの第1の接続部材に上記電流回路を接続し、上記コネクタの第2の接続部材に上記制御回路を接続したことを特徴とする電気接続箱。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、自動車用ワイヤーハーネス等に用いられるコネクタ及び電気接続箱に関するものである。

【0002】

【従来の技術】従来の電気接続箱における回路構成の一例を図17に示す。図において、バスバー基板（第1の回路基板）90と電子回路基板（第2の回路基板）92とが略平行に配せられ、両基板90、92同士の間コネクタ94が介設されている。

【0003】バスバー基板90に組み込まれているバスバー回路（電流回路）には、図略の電線等を介して電源回路等が接続され、このバスバー回路に比較的大きな電流が流れるようになっている。電子回路基板92上には、FET（電界効果トランジスタ）96や、このFET96のゲート端子にゲート信号（制御信号）を入力するゲート信号入力回路等が搭載されている。そして、上記FET96の通電端子（ソース端子及びドレイン端子）が上記コネクタ94内の導通部を介して上記バスバー回路に接続されており、このFET96に入力されるゲート信号によって、上記バスバー回路を流れる電流が制御されるようになっている。

【0004】このように、上記FET96のソース・ドレイン間には、バスバー回路を流れる電流と同等の電流

が流されるが、この電流は、電子回路基板92の制御回路を流れる電流に比べて著しく大きく、よってFET96の発熱量は同じ電子回路基板92上に実装されている電子デバイスに比べて非常に大きくなる。そこで従来は、このFET96を効果的に冷却すべく、FET96の表面に通電端子の一部を露出させる等して放熱部を形成するとともに、この放熱部に図示のような比較的大面積の放熱板98を連結するといった手段がとられている。

【0005】

【発明が解決しようとする課題】上記構成では、FET96が回路基板92上に直接実装されているため、FET96から放たれた熱が同じ電子回路基板92上に実装された他の電子デバイスに伝わり、これらのデバイスの作動に悪影響を及ぼすおそれがある。

【0006】本発明は、このような事情に鑑み、FETをはじめとする制御デバイスの放熱から他の電子デバイスを有効に保護できるコネクタ及び電気接続箱を提供することを目的とする。

【0007】

【課題を解決するための手段】上記課題を解決するための手段として、本発明は、電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスを上記電流回路に接続するための第1の接続部材と、上記制御デバイスをこのデバイスの作動を制御する制御回路に接続するための第2の接続部材とをコネクタハウジング内に一体に組み込んだものである。

【0008】このコネクタによれば、その制御デバイスを第1の接続部材を介して電流回路に接続するとともに、上記制御デバイスを第2の接続部材を介して制御回路に接続することにより、この制御回路で制御デバイスの作動を制御しながら、この制御デバイスによって電流回路の電流を制御できる。この状態では、上記制御デバイスが上記制御回路から離れた位置にあるため、従来のように上記制御デバイスを制御基板上に実装している構造と異なり、制御デバイスから放たれた熱が上記制御基板上の他の電子デバイス等に直接伝えられることが防がれる。

【0009】このコネクタにおいて、上記制御デバイスに放熱部を設け、この放熱部を上記コネクタハウジングの外部に露出させれば、制御デバイスを制御基板上に実装している従来構造に比べ、制御デバイスの発する熱をより効率よく放熱でき、その過昇温を防止できる。

【0010】また、上記制御デバイスの放熱部よりも大きな表面積を有する放熱部材を当該放熱部に連結し、かつ、この放熱部材を上記コネクタハウジングの外部に露出させれば、この制御デバイスからの放熱作用はさらに高められる。

【0011】上記放熱部材は上記制御デバイスの放熱部に直接接触させてもよいが、これらの間に上記放熱部材

ら放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させれば、放熱部からの放熱をさらに促進させることができる。

【0012】さらに、上記コネクタハウジングに、上記冷却素子を上記第2の回路基板の制御回路に接続する冷却用接続部材を一体に組み込み、この冷却用接続部材を介して冷却素子と制御回路とが接続されるようにすれば、この制御回路を利用して冷却素子の作動を制御するといったこともできる。

10 【0013】上記第1の接続部材と第2の接続部材とは、これらが互いに反対の方向を向いているのが好ましい。これにより、制御デバイスを電流回路と制御回路の双方に接続する作業が容易になり、配線構造も簡単になる。

【0014】その際、上記通電端子同士の間には絶縁材料からなるセパレータを介在させることにより、通電端子同士が短絡されるのをより確実に回避できる。

20 【0015】また本発明は、電流回路が組み込まれた第1の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスの作動を制御する制御回路が組み込まれた第2の回路基板とを備えるとともに、上記第1の回路基板と第2の回路基板との間の位置に上記制御デバイスを配設した電気接続箱である。

30 【0016】この構成において、半導体デバイスは両基板同士の間には配設されているので、この半導体デバイスが第2の回路基板上に実装されている従来構造に比べて半導体デバイスから放熱され易く、その過昇温が避けられる。また、この半導体デバイスから放たれた熱が第2の回路基板の電子デバイス等に直接伝えられるのも防ぐことができる。しかも、半導体デバイスは、元来、相互離間している両基板間に配設されているため、電気接続箱全体を大型化する必要がなく、また、半導体デバイスと両基板との接続も容易である。

40 【0017】特に、上記第1の回路基板と第2の回路基板とを略平行な状態で互いに離間させて配置する場合、上記半導体デバイスとして、上記第1の回路基板の電流回路に接続される複数の通電端子と上記第2の回路基板の制御回路に接続される制御端子とが互いに反対の方向に突出するものを用いれば、その通電端子を上記第1の回路基板側に向け、上記制御端子を上記第2の回路基板側に向けた状態で両基板間に半導体デバイスを配することにより、この半導体デバイスの各端子と各基板に組み込まれた回路との接続が簡単にできる。

【0018】また、上記半導体デバイスの放熱部に、この放熱部よりも表面積の大きい放熱部材を連結すれば、この半導体デバイスからの放熱作用はさらに高められる。

50 【0019】この放熱部材の形状や配置は特に問わないが、上記第1の回路基板と第2の回路基板との間に複数

の半導体デバイスを並設するとともに、これら半導体デバイスの放熱部に上記第2の回路基板と略平行に延びる共通の放熱部材を連結すれば、両基板に挟まれた空間を有効に利用して、電気接続箱全体を大型化させずに大面積の放熱部材を導入でき、その分放熱作用をさらに促進できる。また、共通の放熱部材で複数の半導体デバイスの放熱を促進できるため、各半導体デバイスごとに放熱部材を配する場合に比べ、部品点数も削減される。さらに、上記放熱部材が上記第2の回路基板を片側から覆う状態となるため、この放熱部材を第2の回路基板のシールド材として兼用することも可能になる。

【0020】上記放熱部材は上記半導体デバイスの放熱部に直接接触させてもよいが、これらの間に上記放熱部材から放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させれば、放熱部からの放熱をさらに促進させることができる。

【0021】ここで、半導体デバイスの冷却が不要な時（例えば非作動時）に冷却素子が作動する等して半導体デバイスが過冷却されると、この半導体デバイスの表面に結露が発生するといった不都合が生じ得るが、上記冷却素子がペルチェ素子のように外部からの供給電流等によって作動制御が可能な素子である場合、上記半導体デバイスの温度もしくはこれに対応する温度を検出する温度検出手段を備えるとともに、この温度検出手段により検出された温度に基づいて上記冷却素子の作動を制御する冷却制御部を上記第2の回路基板に組み込むことにより、実状に見合った適正な温度制御ができる。

【0022】上記半導体デバイスは、単独で両基板間に配するようにしてもよいが、前記各コネクタを用いる、すなわち、このコネクタの第1の接続部材に上記電流回路を接続し、上記コネクタの第2の接続部材に上記制御回路を接続することにより、電気接続箱全体の組立作業が容易になる。

【0023】

【発明の実施の形態】本発明の第1の実施の形態を図1～図7に基づいて説明する。

【0024】図1に示す電気接続箱10は、ロアケース11とアッパーケース12とを備えている。ロアケース11の側壁11aには係合部11bが形成され、アッパーケース12の側壁12aには係合部12bが形成されており、両係合部11b、12b同士の係合によって両ケース11、12同士の連結状態が保持されるようになっている。

【0025】上記ロアケース11上にはバスバー基板13が配置されている。このバスバー基板13からは、上方に多数のタブ13aが立ち上がっている。このバスバー基板13に組み込まれているバスバー回路（電流回路）には、図略の電線等を介して電源回路等が接続され、このバスバー回路に比較的大きな電流が流されるようになっている。

【0026】ロアケース11の周縁部には、上記バスバー基板13よりもさらに上方に突出する複数の支柱11cが立設され、これらの支柱11cによって電子回路基板14が支持されている。すなわち、この電子回路基板14は、上記バスバー基板13と略平行な状態で、このバスバー基板から上方に離間した位置に支持されている。この電子回路基板14には、多数の電子デバイス15が実装されており、これらの電子デバイス15によって、後述のFET18にゲート信号を入力する制御回路が構成されている。

【0027】そして、この電子回路基板14と上記バスバー基板13との間に、図2～図6に示すようなコネクタ16が介設されている。このコネクタ16は、制御デバイスである上記FET18と、ゲート接続金具（第2の接続部材）20と、ドレイン接続金具（第1の接続部材）21と、ソース接続金具（第2の接続部材）22と、放熱板24とを備え、これら全体がモールド成形によって樹脂製のコネクタハウジング26に一体に組み込まれている。

【0028】コネクタハウジング26は、電子回路基板14の周縁部と平行に延び、その上端部は電子回路基板14側に屈曲している。そして、この屈曲部分に、上記電子回路基板14の周縁部が側方から差し込み可能な二股状のクリップ部26aが形成されている。

【0029】FET18は、図7(a)～(c)に示すように、FET本体である半導体チップ28と、ゲート端子（制御端子）30と、ドレイン端子（通電端子）31と、ソース端子（通電端子）32とが樹脂製のハウジング34でカバーされたものであり、モールド成形等によって製造が可能である。

【0030】上記ゲート端子30及びソース端子32は、上記半導体チップ28において同じ側の側面（図7(b)では右側面）に接合されており、これと反対側の側面に上記ドレイン端子31が接合されている。このドレイン端子31において上記側面に接合される部分は、当該側面と同等の面積を有する放熱部31aとされており、この放熱部31aが上記ハウジング34の側面に露出している。

【0031】さらに、このFET18の特徴として、上記3つの端子30～32のうち、ゲート端子30のみが上記半導体チップ28から上方に延び、ハウジング34の上面から上方に突出しており、残りのドレイン端子31及びソース端子32は、互いに左右に並んだ状態で略平行に下方に延び、それぞれハウジング34の下面から下方に突出している。

【0032】ゲート接続金具20は、コネクタ16の上部に配されており、このゲート接続金具20の下端が上記FET18のゲート端子に連結されている。このゲート接続金具22の上部は側方に屈曲し、その先端部分には、上記コネクタハウジング26のクリップ部26aと

同様、上記電子回路基板14の周縁部を上下から挟持可能な(すなわち電子回路基板14が側方から差し込み可能な)二股状のクリップ部20aが形成されている。そして、このクリップ部20aが電子回路基板14の周縁部を挟持した状態で、この電子回路基板14の制御回路を構成する導体部分14aが上記クリップ部20aと接触し、上記制御回路がゲート接続金具20を介してFET18のゲート端子30に電氣的に接続されるようになっている。

【0033】ドレイン接続金具21及びソース接続金具22は、互いに同一の形状、具体的には、上下に延び、その上下両端に雌型の係合部を有する形状をなしており、ドレイン接続金具21の上端部に上記FET18のドレイン端子31の下端部が差し込まれ、ソース端子22の上端部にソース端子32の下端部が差し込まれている。

【0034】両接続金具21、22同士の間には、絶縁体からなるセパレータ36が介在している。これら接続金具21、22及びセパレータ36は全体がモールド成形によって一体化されており、このセパレータ36の介在によって両接続金具21、22同士の絶縁が確保されている。そして、両接続金具21、22の下端部に上記バスバー基板13における適当なタブ13aが下方から差し込まれることにより、これらタブ13aが各接続金具21、22を介して上記ドレイン端子31及びソース端子32に個別に接続されるようになっている。すなわち、バスバー回路中にFET18が組み込まれるようになっている。

【0035】放熱板24は、アルミニウム等の導電性に優れた材料で成形され、コネクタハウジング26と略同等の寸法まで水平に延びる形状を有している。そして、この放熱板24の表面がコネクタハウジング26の外側面(電子回路基板14と反対側の側面;図2では右側面)に露出した状態で、この放熱板24もコネクタハウジング26に組み込まれている。この放熱板24の表面には、水平に延びる多数の突条24aが形成されており、これにより放熱板24の放熱面積が増やされている。

【0036】この放熱板24の内側面には凹部24bが形成され、この凹部24bにFET18のハウジング34の一側部(具体的にはドレイン端子31aの放熱部31aが露出している側の側部)が嵌入されることにより、FET18の放熱部31aと放熱板24とが接触した状態でこれらFET18と放熱板24とが一体に結合されている。

【0037】次に、この電気接続箱10の作用を説明する。

【0038】バスバー基板13に組み込まれたバスバー回路の中には、図略の電線等を介して比較的大きな電流が

きな電流は、途中、図2～図6に示されるタブ13a→ソース接続金具22→FET18のソース端子32→半導体チップ28→ドレイン端子31→ドレイン接続金具21→タブ13aの順に流れ、バスバー回路から出力される。一方、上記FET18のゲート端子30には、電子回路基板14に組み込まれた制御回路からゲート接続金具20を介してゲート信号が入力され、このゲート信号によって上記FET18におけるソースドレイン間の通電量が制御される。

【0039】このように、FET18にはバスバー回路を流れる電流と同等の電流が流れるため、FET18には発熱が起こる。ここで従来は、FET18が他の電子デバイスとともに電子回路基板14上に実装されていたため、たとえこのFET18に放熱板等を連結したとしても十分な放熱作用は得られにくく、また、このFET18の発する熱が他の電子デバイスに伝わってこれらの電子デバイスの性能にも悪影響を及ぼすおそれがあったが、図1～図7に示す電気接続箱10では、FET18がバスバー基板13及び電子回路基板14の双方から離れた状態で両基板13、14同士の間の位置に配されており、FET18の放熱部31aと接触する放熱板24がコネクタハウジング26の外方に露出した状態にあるため、このFET18の放熱作用が高く、また、その放たれた熱が電子回路基板14上の各電子デバイスに悪影響を与えるのを防ぐことができる。しかも、両基板13、14は元々互いに離間した状態で配置されるものであるため、これら間にFET18を配設するのに電気接続箱10を特に大型化する必要もない。

【0040】第2の実施の形態を図8に示す。前記第1の実施の形態では、コネクタ16の外側面にFET18の放熱部31aを向け、この放熱部31aに連結した放熱板24を上記外側面に露出させているが、この第2の実施の形態では、上記放熱部31aをコネクタ16の内側面に向け、この放熱板31aに連結した放熱板24を上記内側面に向けている。

【0041】このように、本発明において放熱板24等の放熱部材の具体的な配置は問わず、コネクタハウジング26から十分に露出していれればよい。

【0042】第3の実施の形態を図9に示す。ここでは、電子回路基板14の両端部がコネクタ16を介してバスバー基板13に連結されている。すなわち、電子回路基板14とバスバー基板13との間に2つのコネクタ16が相対向する状態で配設されている。そして、各コネクタ16において互に対向する面(内側面)に、それぞれのコネクタ16に組み込まれているFET18の放熱部31aが直接露出しており、これら放熱部31aに単一の放熱板38が連結されている。すなわち、この放熱板38は、バスバー基板13と電子回路基板14との間にこれらと略平行な状態で配され、両コネクタ16の放熱部31a同士の間を介在している。また、この放

熱板38の下面には多数枚のフィン38aが形成され、これにより放熱面積の増加が図られている。

【0043】このような構成によれば、前記第1及び第2の実施の形態で得られる効果に加え、次のような効果を得ることができる。

【0044】① バスバー基板13と電子回路基板14とに挟まれた空間を有効に利用することにより、電気接続箱10全体を大型化することなく大面積の放熱板38を配設できる。従って、コンパクトな構造でありながら優れた放熱作用を得ることができる。

【0045】② 共通の放熱板38によって複数のコネクタ16におけるFET18からの放熱を促進でき、部品点数を削減できる。

【0046】③ 金属製の放熱板38により、電子回路基板14の下面をほぼ全域にわたってカバーすることができるので、この放熱板38はシールド材として兼用が可能であり、これにより電子回路基板14を電磁波から有効に保護することができる。さらに、前記アップケース12にも金属板を配して電子回路基板14を上方からも金属板で覆うようにすれば、遮蔽効果は万全となる。

【0047】次に、第4の実施の形態を図10～図12に基づいて説明する。

【0048】この実施の形態では、前記第1の実施の形態で示したコネクタ16において、FET18の放熱部31aと放熱板24との間にペルチェ素子（冷却素子）40が介設されている。このペルチェ素子40は、一対の端子を備え、これらの端子同士の間には電流が流されるのに伴い、この電流の大きさに対応する度合いで、上記放熱部31aから放熱板24に向かう方向に強制的に熱移動を起こさせるように構成されている。

【0049】一方、前記FET18には、図12に示すような温度センサ（温度検出手段）42が組み込まれている。この温度センサ42は、熱電対等からなり、FET18の発熱温度に相当する電気信号を出力するように構成されている。

【0050】図11に示すように、コネクタ16の上部には、前記ゲート接続金具20と水平に並ぶ状態で、このゲート接続金具20と同等の形状（すなわち電子回路基板14を挟むクリップ部を有する形状）の一対の冷却用接続金具（冷却用接続部材）50A、50B及び検出用接続金具（検出用接続部材）52が組み込まれている。各冷却用接続金具50A、50Bには、図略のコネクタ内配線を介して前記ペルチェ素子40の各端子が接続され、検出用接続金具52には上記温度センサ42の出力端子が接続されている。そして、上記各接続金具20、50A、50B、52のクリップ部に電子回路基板14の周縁部適所が同時に差し込まれることにより、この電子回路基板14に組み込まれた制御回路に上記ゲート端子30、ペルチェ素子40の両端子、及び温度セン

サ42の出力端子が同時接続されるようになっている。

【0051】上記電子回路基板14に組み込まれた制御回路は、上述のゲート信号発生部の他、図12に示すような温度データ解析部44、電流調節部46、及び警告指令部48を備えている。

【0052】温度データ解析部44は、温度センサ42から入力される温度データを解析するものであり、検出温度が第1の判定値以上の場合にその温度に対応した制御信号を電流調節部46に出力し、検出温度が上記第1の判定値よりも高い第2の判定値以上の場合に警告指令部48に警告制御信号を出力するように構成されている。

【0053】電流調節部46は、上記温度データ解析部44から制御信号が入力された場合に、この制御信号に対応する電流をペルチェ素子40の両端子間に流すものである。すなわち、この電流調節部46は、上記検出温度が一定以上の場合にその温度が高いほど大きな電流をペルチェ素子40の両端子間に流すように構成されている。また、警告指令部48は、上記温度データ解析部44から制御信号が入力された場合に、電気接続箱外部に設けられた図略の警告手段に指令信号を出力し、警告を行わせるように構成されている。

【0054】このような構成によれば、FET18の発熱が著しくなると、ペルチェ素子40の両端子間が通電されてペルチェ素子40が作動し、FET18から放熱板40への強制的な熱移動が引き起こされるので、これによりFET18から放熱板24を通じての外気への放熱が促進され、FET18の過度の温度上昇が回避される。また、FET18の温度が比較的低い場合には、ペルチェ素子40の作動が停止されるので、FET18の過冷却による不都合（例えば結露の発生）も防ぐことができる。

【0055】なお、この実施の形態において、検出の対象となる温度は、上記FET18自身の発熱温度に限らず、その雰囲気温度やゲート接続金具20の温度を検出するようにしてもよい。また、ペルチェ素子40の高温側面（図10及び図11では左側面）の温度を検出し、この温度が過度に上昇した場合にペルチェ素子40の通電を止めるようにすれば、ペルチェ素子40自身の故障を防ぐこともできる。

【0056】また、このペルチェ素子40を導入できるコネクタ16は前記第1の実施の形態に示したものに限られず、例えば第5の実施の形態として図13に示すように、前記第3の実施の形態で示した両コネクタ16と放熱板38の両端との間にそれぞれペルチェ素子40を介在させるようにしてもよい。

【0057】第6の実施の形態を図14(a)(b)に示す。前記各実施形態では、制御デバイスとしてFETを用い、これを組み込んだコネクタ16を電気接続箱内での接続に用いたものを示したが、この実施の形態で

は、制御デバイスとしてIPS(Intelligent Power Switch)を組み込んだコネクタ16を用いるとともに、このコネクタ16を、電気接続箱内においてではなく、電源及び負荷に直接接続してその導通制御を行うようにしている。

【0058】上記IPSは、パワー部60と、インテリジェント部62とを有している。パワー部60内には、FET等からなるスイッチング素子や内部電源、感温素子等が組み込まれている。インテリジェント部62は、論理回路等で構成され、上記感温素子等の検出信号に基づいて異常の有無を判定する機能や、外部の制御回路から入力される指令に基づいて上記スイッチング素子のオンオフ制御を行う機能等を備えている。

【0059】インテリジェント部62には、アース端子63と、上記指令が入力される入力端子64と、上記制御回路に異常診断信号を出力するための診断出力端子65とが設けられ、これらの端子に接続金具68が装着されている。一方、上記パワー部60には、電源端子67と出力端子66とが設けられ、電源端子67に接続金具77が、出力端子66に接続金具76が装着されている。そして、これら全体を一体化すべくその外側にコネクタハウジング70がモールド成形されてコネクタ16が構成されており、上記入力端子64及び診断出力端子65がそれぞれ接続金具(第2の接続部材)68を介して上記制御回路に接続されるとともに、電源端子67が接続金具(第1の接続部材)77を介して電源に接続され、かつ、出力端子66が接続金具(第1の接続部材)76を介して負荷に接続されている。

【0060】このようなコネクタ16を用いても、制御デバイスであるIPSの作動により電源-負荷間の通電をオンオフし、かつ、このIPSの作動を制御回路によって制御することができる。そして、この制御回路からIPSを離間させることによって、制御回路の回路要素を保護でき、また、上記IPSの例えば電源端子67をコネクタハウジング70の外面に露出させることにより、効率のよい放熱ができる。さらに、前記と同様、放熱板や適当な冷却素子を導入することにより、放熱効果を高めることができる。

【0061】また、上記IPSが複数のスイッチング素子を内蔵する場合、すなわち、第7の実施の形態として図15(a)(b)に示すように複数の入力端子64及び出力端子66を有する場合も、前記第6の実施の形態と同様に全体が一体化されたコネクタ16を構成することができる。

【0062】なお、本発明のコネクタは、前記図2に示したようにバスバー基板13及び電子回路基板14に直接接続する場合に限らず、第1の接続部材を電線を介して電流回路に接続するようにしてもよいし、第2の接続部材を電線を介して制御回路に接続するようにしてもよい。例えば図14(a)(b)に示したコネクタ16の

場合、接続金具68や、接続金具76、77に上記電線の末端に設けた電線端子やコネクタを接続するようにしてもよい。

【0063】このように、本発明のコネクタを電流回路及び制御回路にそれぞれ電線を介して接続した構造には、コネクタの配設位置を自由に設定できるので、特にコネクタ内部に挿入された電子デバイスの放熱が著しい場合、コネクタ部分のみを環境温度が低い場所に設置することにより、上記電子デバイスの熱暴走を防ぐことができる利点が得られる。

【0064】これに対し、電流回路側においてはその負荷あるいは電源端子に本発明のコネクタの第1の接続部材を直接接続し、制御回路側には本発明のコネクタの第2の接続部材を電線を介して接続する配線形態をとれば、比較的熱に弱い上記制御回路から電流回路を大きく離間させながら、電流回路と本発明のコネクタとの間の経路すなわち大電流が流れる経路を最短化でき、この経路に大電流用の太径電線を配する必要をなくしてコストを著しく削減することが可能である。また、上記大電流経路から出るノイズを最小限の遮断材料を用いて防ぐことができる。

【0065】また逆に、電流回路に対しては本発明のコネクタの第1の接続部材を電線を介して接続し、制御回路が組み込まれた回路基板の基板用コネクタ等に第2の接続部材を直接接続できるようにした場合には、制御回路と電流回路とを大きく離間させながら、上記基板用コネクタ等に本発明のコネクタを簡単に結合できる利点が得られる。また、大電流が上記回路基板上を流れないので、当該基板の温度上昇や輻射ノイズの発生を防ぐことができ、この基板に組み込まれた制御回路の誤動作を防止できる利点が得られる。

【0066】本発明においてコネクタ16を製造する方法は種々考えられるが、その一例を図16(a)~(c)に示す。

【0067】まず、図16(a)に示すように、IPSのパワー部60に電源端子67及び出力端子66を装着したものを製造する一方、同図(b)に示すように、アース端子用接続金具73、診断出力端子用接続金具74、及び入力端子用接続金具75が固定されたコネクタハウジング72をモールド成形しておき、このコネクタハウジング72に形成した凹部72aに前記図16

(a)で示したものを固定する。次に、同図(c)に示すように、パワー部60の各端子を上記各接続金具73、74、75にワイヤ78を介して接続する(すなわちワイヤボンディング等で接続する)とともに、電源端子67及び出力端子66にそれぞれ接続金具77、76を装着する。そして、少なくとも上記ワイヤ78による接続部分を樹脂モールド等で覆い、必要に応じてコネクタハウジング72に上から蓋を被せることにより、コネクタを完成することができる。

【0068】本発明は、上記の実施の形態のほか、例として次のような形態をとることも可能である。

【0069】(1) 前記第1の実施の形態等において、コネクタハウジング26を省略し、FET18を外部に完全露出させた状態で両基板13、14同士の間介設することも可能である。この場合も、FET18の放熱部に放熱板24等の放熱部材を連結したり、この放熱部材とFET18との間にバルチェ素子40を介在させたりすることにより、放熱効果を促進させることができる。ただし、前記各実施形態のように、上記FET18を各接続金具20〜22とともに単一のコネクタ16として一体化すれば、電気接続箱10全体の組立作業を容易化できる利点が得られる。

【0070】(2) 本発明における制御デバイスは上記FET18やIPsに限らず、その他、IGBT (Insulated Gate Bipolar Transistor)、BPT (Bipolar Transistor)、各種レギュレータ、パワーモジュール等が適用可能である。ただし、前記各実施形態に示したように、制御端子(図例ではゲート端子30)と通電端子(図例ではドレイン端子31及びソース端子32)とが互いに反対の側に突出する制御デバイスを用いれば、上記通電端子が上記バスバー基板13側(図例では下側)を向き、かつ、制御端子が電子回路基板14側(上側)を向く状態でこの制御デバイスを両基板13、14間に介設することにより、接続構造を簡素化できる利点が得られる。

【0071】(3) 本発明における第1の回路基板は上記のようなバスバー基板13に限らず、絶縁材料からなる基板に導体が組み込まれた各種回路基板を適用することが可能である。

【0072】

【発明の効果】以上のように本発明は、電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスを上記電流回路に接続するための第1の接続部材と、上記制御デバイスをこのデバイスの作動を制御する制御回路に接続するための第2の接続部材とをコネクタハウジング内に一体に組み込んだコネクタであるので、このコネクタを上記電流回路と制御回路とに接続することにより、電流回路における電流の制御を行いながら、制御デバイスの放熱から上記制御回路を構成する他の電子デバイス等を保護できる効果がある。

【0073】そして、このコネクタの制御デバイスに放熱部を設け、この放熱部を上記コネクタハウジングの外部に露出させることにより、制御デバイスの発する熱を効率よく放散でき、その過昇温を防止できる効果が得られる。

【0074】また、上記制御デバイスの放熱部よりも大きな表面積を有する放熱部材を当該放熱部に連結し、かつ、この放熱部材を上記コネクタハウジングの外部に露出させることにより、放熱効果をさらに顕著にできる。

【0075】さらに、上記放熱部材と放熱部との間に上記放熱部から放熱部材に向けて強制的に熱移動させることにより放熱部を冷却する冷却素子を介在させたものによれば、放熱部からの放熱を積極的に促進させることができる効果が得られる。

【0076】さらに、上記コネクタハウジングに、上記冷却素子を上記第2の回路基板の制御回路に接続する冷却用接続部材を一体に組み込んだものによれば、この冷却用接続部材を介して冷却素子と制御回路とを接続することにより、この制御回路を利用して冷却素子の作動を制御できる効果が得られる。

【0077】また、上記第1の接続部材と第2の接続部材とが互いに反対の方向を向いているものによれば、制御デバイスを電流回路と制御回路の双方に接続する作業を容易にでき、配線構造も簡素化できる効果が得られる。

【0078】さらに、上記通電端子同士の間絶縁材料からなるセパレータを介在させることにより、通電端子同士が短絡されるのをより確実に回避できる効果が得られる。

【0079】また本発明は、電流回路が組み込まれた第1の回路基板と、上記電流回路を流れる電流を制御するための制御デバイスと、この制御デバイスの作動を制御する制御回路が組み込まれた第2の回路基板とを備えるとともに、上記第1の回路基板と第2の回路基板との間の位置に上記制御デバイスを配設した電気接続箱であるので、この制御デバイスが第2の回路基板上に実装されている従来構造に比べ、制御デバイスの放熱を促進してその良好な作動を確保できるとともに、この制御デバイスから放たれた熱が第2の回路基板の電子デバイス等に悪影響を与えるのを防止できる効果がある。また、制御デバイスを両基板間の位置に配するのに電気接続箱全体を特別に大型化する必要もなく、コンパクトな構造で上記効果が得られ、制御デバイスと両基板との接続も容易化できる。

【0080】特に、上記第1の回路基板と第2の回路基板とを略平行な状態で互いに離間させて配置する場合、上記制御デバイスとして、上記第1の回路基板の電流回路に接続される複数の通電端子と上記第2の回路基板の制御回路に接続される制御端子とが互いに反対の方向に突出するものを用いれば、その通電端子を上記第1の回路基板側に向け、上記制御端子を上記第2の回路基板側に向けた状態で両基板間に制御デバイスを配することにより、この制御デバイスの各端子と各基板に組み込まれた回路との接続を簡単にできる効果が得られる。

【0081】また、上記制御デバイスの放熱部に、この放熱部よりも表面積の大きい放熱部材を連結すれば、この制御デバイスからの放熱をさらに促進できる効果が得られる。

【0082】上記第1の回路基板と第2の回路基板との

間に複数の制御デバイスを並設するとともに、これら制御デバイスの放熱部に上記第2の回路基板と略平行に延びる共通の放熱部材を連結したものによれば、両基板に挟まれた空間を有効に利用して、電気接続箱全体を大型化させずに大面積の放熱部材を導入でき、その分放熱作用をさらに促進できるとともに、部品点数も削減できる効果が得られる。さらに、上記放熱部材が上記第2の回路基板を片側から覆う状態となるため、この放熱部材を第2の回路基板のシールド材として兼用することにより、第2の回路基板における制御回路を電磁波から有効に保護できる効果も得られる。

【0083】上記放熱部材と上記制御デバイスの放熱部との間に冷却素子を介在させ、上記放熱部から放熱部材に向けて強制的に熱移動させるようにすれば、放熱部からの放熱をさらに促進させて、制御デバイスの過昇温をさらに確実に防止できる効果が得られる。

【0084】さらに、上記制御デバイスの温度もしくはこれに対応する温度を検出する温度検出手段を備えとともに、この温度検出手段により検出された温度に基づいて上記冷却素子の作動を制御する冷却制御部を上記第2の回路基板に組み込むようにすれば、この制御回路を有効に利用して実状に見合った適正な温度制御ができる効果が得られる。

【図面の簡単な説明】

【図1】本発明の第1の実施の形態における電気接続箱の全体構造を示す分解斜視図である。

【図2】上記電気接続箱に設けられるコネクタの一部断面側面図である。

【図3】上記コネクタの正面図である。

【図4】図3のA-A線断面図である。

【図5】上記コネクタのコネクタハウジング内に組み込まれる各部品の分解斜視図である。

【図6】上記コネクタのコネクタハウジング内に組み込まれている各部品の組立斜視図である。

【図7】(a)は上記コネクタに組み込まれるFETの背面図、(b)は同FETの側面図、(c)は同FETの正面図である。

【図8】本発明の第2の実施の形態における電気接続箱のコネクタの一部断面側面図である。

【図9】本発明の第3の実施の形態における電気接続箱の要部を示す側面図である。

【図10】本発明の第4の実施の形態における電気接続

箱のコネクタの一部断面側面図である。

【図11】図10のコネクタの平面図である。

【図12】前記第4の実施の形態において電子回路基板に組み込まれる制御回路の機能構成を示すブロック図である。

【図13】本発明の第5の実施の形態における電気接続箱の要部を示す側面図である。

【図14】(a)は本発明の第6の実施の形態におけるコネクタの平面図、(b)は同コネクタの底面図である。

【図15】(a)は本発明の第7の実施の形態におけるコネクタの平面図、(b)は同コネクタの底面図である。

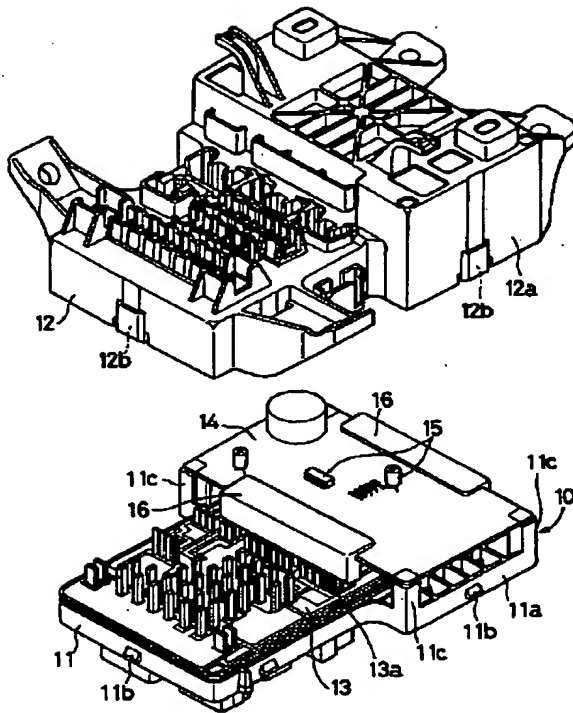
【図16】(a)～(c)は本発明のコネクタの製造工程の一例を示す一部断面斜視図である。

【図17】従来の電気接続箱の内部構造の一例を示す斜視図である。

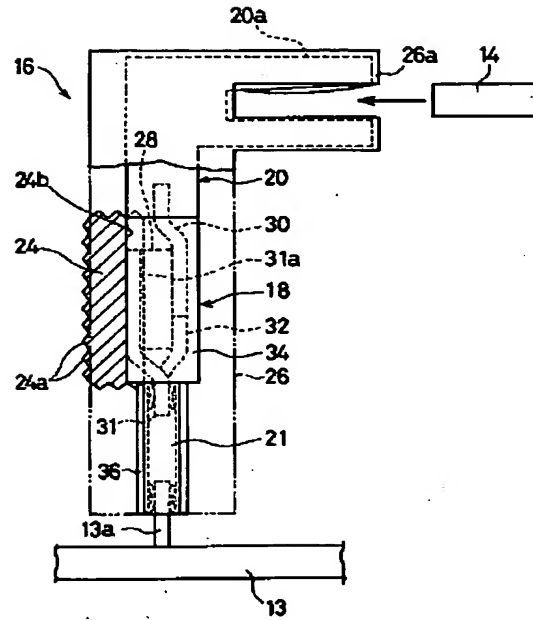
【符号の説明】

- 10 電気接続箱、
- 13 バスバー基板(第1の回路基板)
- 14 電子回路基板(第2の回路基板)
- 16 コネクタ
- 18 FET(制御デバイス)
- 20 ゲート接続金具(第2の接続部材)
- 21 ドレイン接続金具(第1の接続部材)
- 22 ソース接続金具(第1の接続部材)
- 24, 38 放熱板(放熱部材)
- 26, 70, 72 コネクタハウジング
- 28 半導体チップ(FET本体)
- 30 ゲート端子(制御端子)
- 31 ドレイン端子(通電端子)
- 32 ソース端子(通電端子)
- 36 セパレータ
- 40 ペルチェ素子(冷却素子)
- 42 温度センサ(温度検出手段)
- 44 温度データ解析部(冷却制御部を構成)
- 46 電流調節部(冷却制御部を構成)
- 50A, 50B 冷却用接続金具(冷却用接続部材)
- 60 本体チップ(制御デバイスを構成)
- 68 接続金具(第2の接続部材)
- 76, 77 接続金具(第1の接続部材)

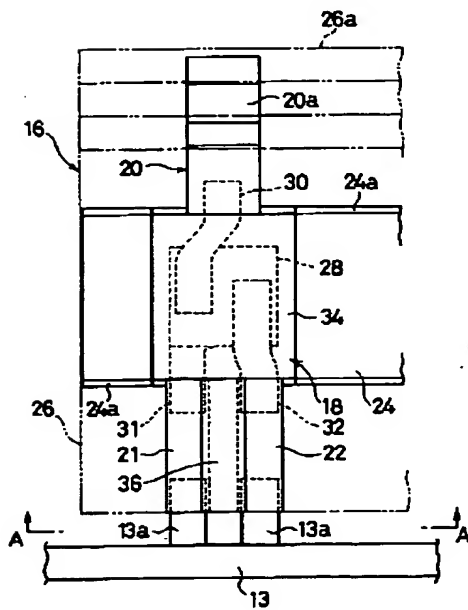
【図1】



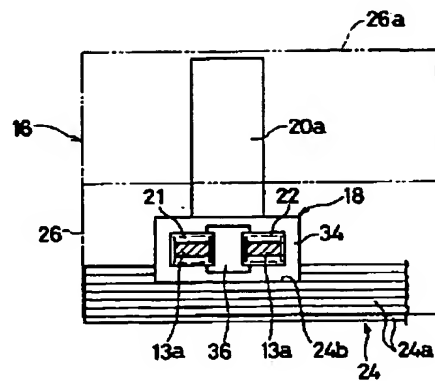
【図2】



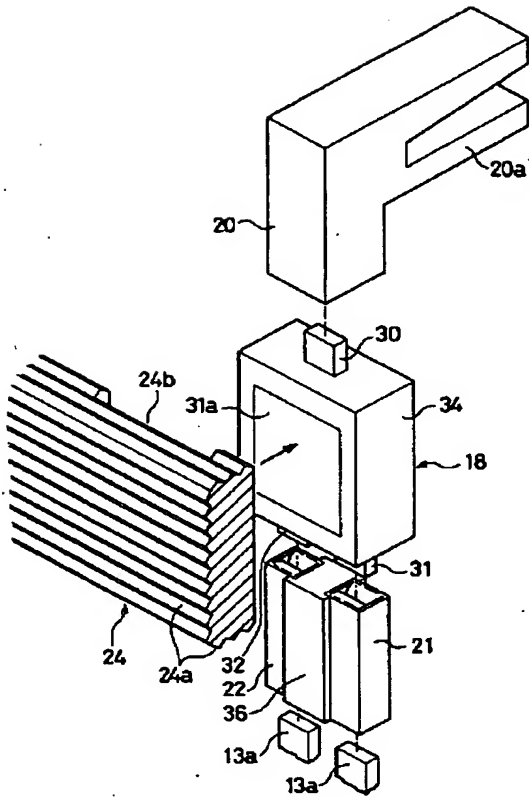
【図3】



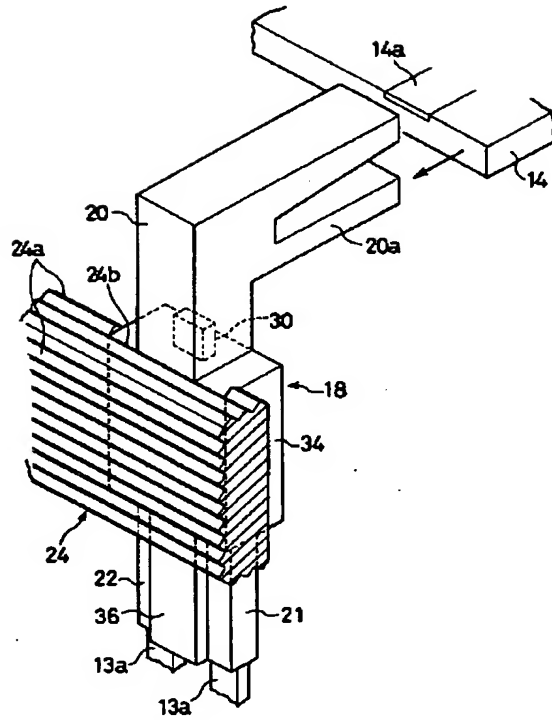
【図4】



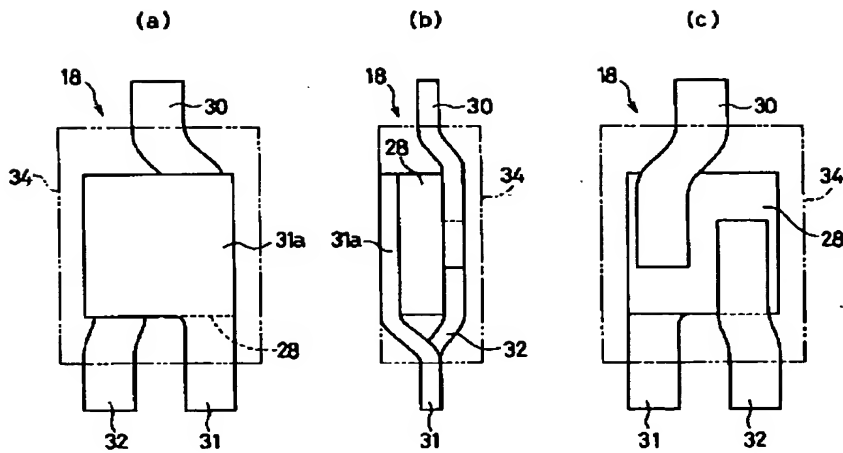
【図5】



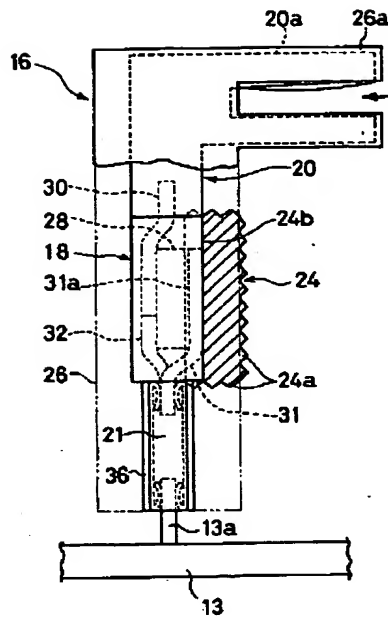
【図6】



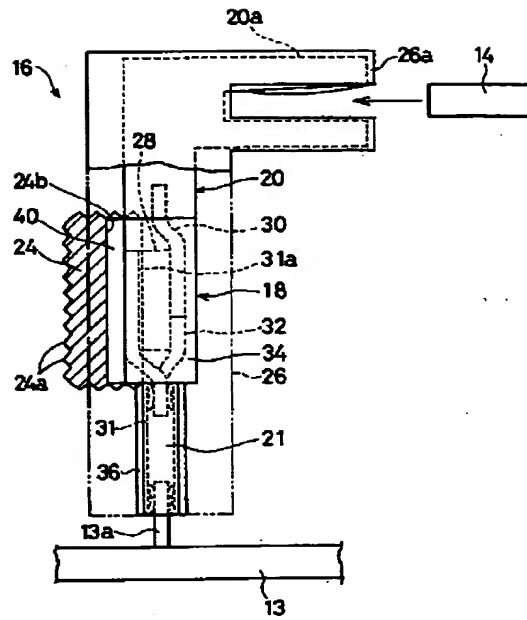
【図7】



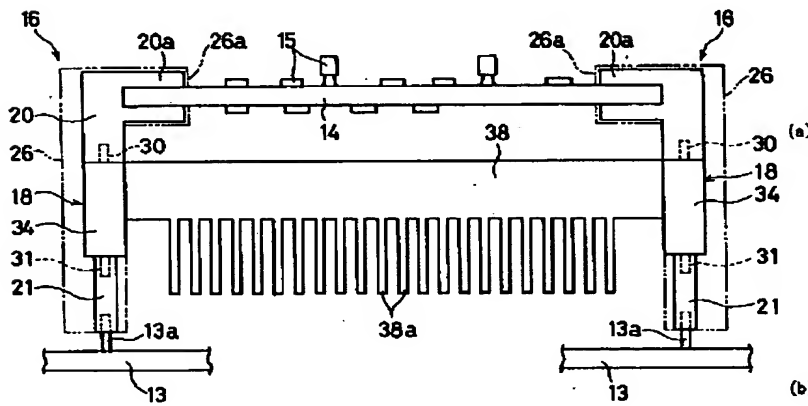
【図8】



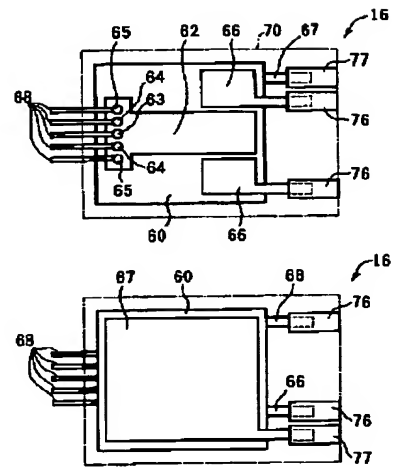
【図10】



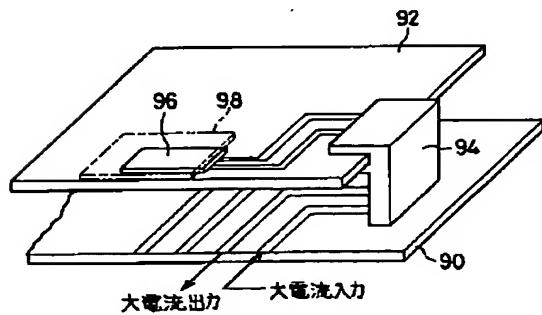
【図9】



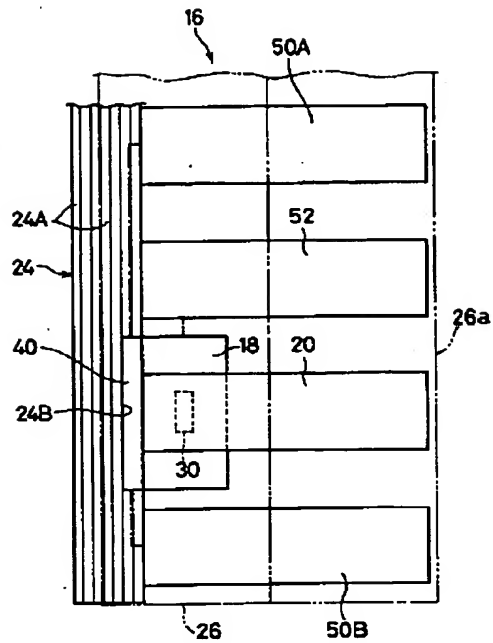
【図15】



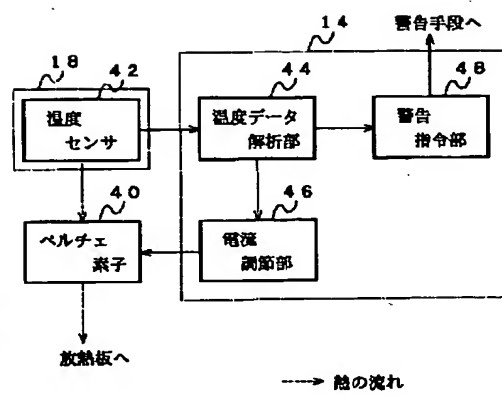
【図17】



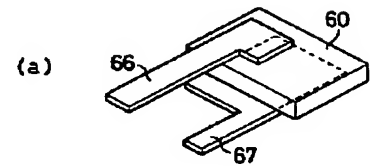
【図11】



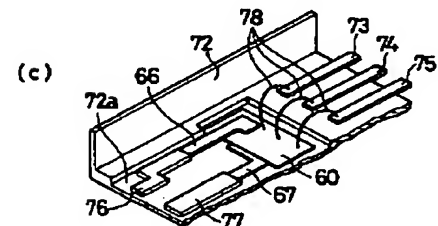
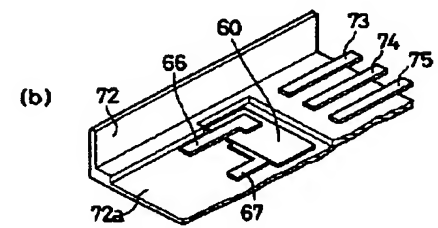
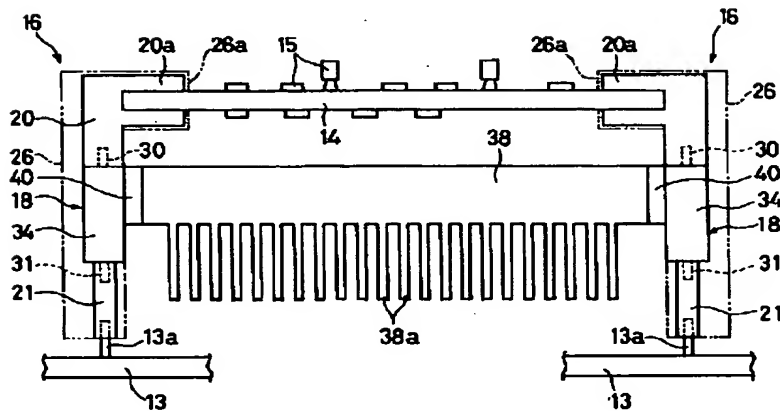
【図12】



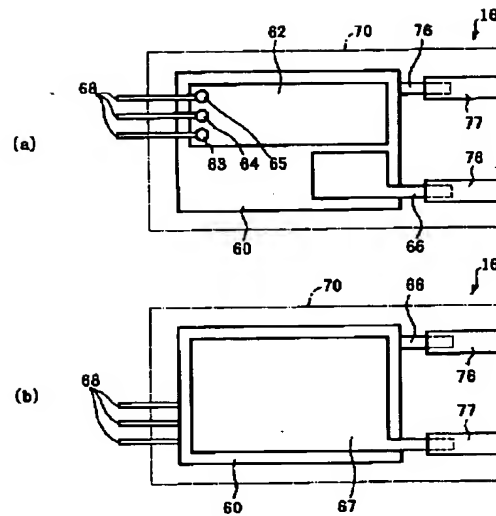
【図16】



【図13】



【図14】



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